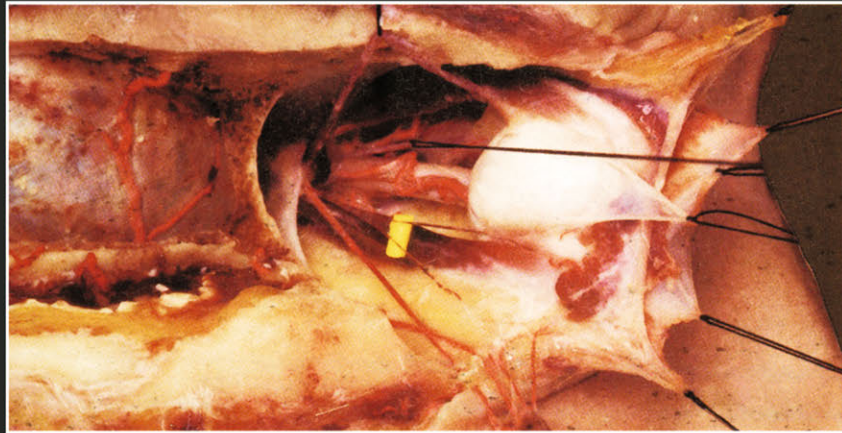


Photographic Atlas of Practical Anatomy



Springer-Verlag Berlin Heidelberg GmbH

WALTER THIEL

Photographic
Atlas
of Practical
Anatomy

II

Neck · Head · Back
Chest · Upper Extremities

Translated by Terry C. Telger
With the Assistance of Udo Schumacher

With 205 Color Figures



Springer

Prof. Dr. Walter Thiel
Anatomisches Institut
University of Graz
Harrachgasse 21
8010 Graz/Austria

Translators:

Terry C. Telger
Translations for Health Sciences
6112 Waco Way
Fort Worth, TX 76133/USA

Prof. Dr. Udo Schumacher
Anatomisches Institut
Universitätskrankenhaus
Eppendorf
Martinistr. 52
20246 Hamburg/Germany

German edition
© Springer-Verlag Berlin Heidelberg 1999

Spanish edition
© Springer-Verlag Ibérica, S. A. Barcelona 1999

Cataloging-in-Publication Data applied for
Die Deutsche Bibliothek – CIP-Einheitsaufnahme

Thiel, Walter:
Photographic atlas of practical anatomy / Walter Thiel.
Transl. by Terry C. Telger with the assistance
of Udo Schumacher.
Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ;
London ; Milan ; Paris ; Singapore ; Tokyo : Springer
Dt. Ausg. u. d. T.: Thiel, Walter: Photographischer Atlas der
praktischen Anatomie

II. Neck, Head, Back, Chest, Upper Extremities. – 1999
Companion Vol. Including Nomina Anatomica and Index. – 1999
ISBN 978-3-642-64137-4 ISBN 978-3-642-59819-7 (eBook)
DOI 10.1007/978-3-642-59819-7

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilm or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1999
Originally published by Springer-Verlag Berlin Heidelberg 1999
Softcover reprint of the hardcover 1st edition 1999

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Product liability: The publishers cannot guarantee the accuracy of any information about the application of operative techniques and medications contained in this book. In every individual case the user must check such information by consulting the relevant literature.

Cover design: Erich Kirchner, Heidelberg
Reproduction of the figures: Reproteam, Graz
Typesetting: Data conversion by Appl, Wemding

SPIN 10563474 15/3135 – 5 4 3 2 1 0 Printed on acid-free paper

Prologue

The dissections pictured in this book
are from individuals
who willed their bodies to medical science
that they might benefit the sick.

THEIR DEATH CARRIES THE DIGNITY
OF RENDERING SELFLESS SERVICE TO THE LIVES OF OTHERS

Preface

In the Preface to the first volume of the *Photographic Atlas of Practical Anatomy*, we explained our special interpretation of the structure of the superficial fascia of the human body. The second volume of the *Atlas* retains this concept and further substantiates its validity.

The order in which the anatomic regions are presented may seem unconventional, but it is intended to reflect the importance of “transitional regions” in understanding anatomic relationships. Wherever possible, regions that border one another are presented in sequence. Additionally, we wanted the format of the second volume to follow that of the first, so the joints are placed at the end of the book and the preceding pages are devoted to the upper limb.

We start with the neck, as it provides a logical transition to the head. The nuchal region serves the same function for the back, which, as part of the thoracic cage, forms a gateway to the lateral and anterior chest wall and finally to the upper limbs, which originally developed from the torso as ventral buds.

A photographic presentation, more than any other, is bound to reflect individual variations. This is not necessarily a disadvantage, and we hope that our approach will serve to “flesh out” general and abstract principles.

Our reference list covers only works that relate directly to the second volume. Other sources may be found by consulting the more comprehensive bibliography and preface of Volume I.

Graz, autumn 1998

Walter Thiel

Table of Contents

Figure		Page
1	Superficial Cervical Region, Punctum Nervosum	2–3
2–9	Median Cervical Region, Sternocleidomastoid Region . . .	4–19
8–18	Carotid Triangle	16–37
10–12	Exposure of Common Carotid Artery	20–25
13–18	Carotid Triangle, Overall Structure, Anterior Approach to the Cervical Spine	26–37
19–28	Thyroid Region	38–57
27–29	Scalenovertebral Triangle	54–59
30–32	Lateral Cervical Region	60–65
33–34	Submandibular Triangle, Superficial Cervical Region	66–69
35–39	Parotid-Masseter Region	70–79
40–42	Lateral Facial Region, Temporal Region	80–85
43–45	Infratemporal Fossa	86–91
46–49	Approach to the Middle Meningeal Artery, Orbit and Temporal Region	92–99
50–51	Orbital Region	100–103
52–60	Occipital Region, Posterior Cervical Region, Suboccipital Puncture	104–121
61–63	Suprascapular Region, Posterior Cervical Region	122–127
64–68	Dorsum of the Thorax, Suprascapular, Interscapular and Scapular Region	128–137
69–74	Dorsum of the Thorax, Posterior Cutaneous Branches, Vertebrolumbar Region	138–149
75–77	Lumbar Puncture, Lumbar Region	150–155
78–85	Pectoral Region	156–171
86–95	Female Breast	172–191
96–107	Thoracic Cavity, Right Lung, Root of the Lung, Pulmonary Arteries, Left Lung	192–215
108–110	Posterior Mediastinum, Root of the Lung, Pulmonary Sulcus	216–221
111–113	Pericardium, Pericardial Cavity	222–229
114–122	Heart	230–247
115–117	Locating the Coronary Arteries	232–237
123–127	Infraclavicular Region	248–257
128–139	Axilla, Axillary Space	258–281
140–141	Arm and Axilla	282–285

Figure		Page
142–148	Arm, Posterior Brachial Region, Locating the Radial Nerve .	286–299
149–157	Anterior Cubital Region, Subcutaneous Veins, Superficial Fascia, Various Layers	300–317
158–164	Anterior Antebrachial Region, Various Layers	318–331
165	Anterior Carpal Region	332–333
166–173	The Hand, Palm of the Hand, Palmar Aponeurosis, Structure of the Finger, Carpal Tendon Sheaths	334–349
174–177	The Hand, Digital Tendon Sheaths	350–357
178–181	Posterior Antebrachial Region, Various Layers	358–365
182–183	The Hand, Dorsum of the Hand, Dorsal Digital Expansion .	366–369
184–188	Shoulder Joint, Puncture Sites	370–379
189–195	Elbow Joint, Collateral Ligaments, Puncture Sites	380–393
196–205	Joints of the Hand, Aspects, Carpal Joint Mechanics, Puncture Sites	394–413
	Addenda to Figure 49	414–415
	Bibliography and Proper Names	417–422

WALTER THIEL

Photographic
Atlas
of Practical
Anatomy

II

Companion Volume
Including Nomina Anatomica
and Index

Translated by Terry C. Telger
With the Assistance of Udo Schumacher

With 205 Figures



Springer

Table of Contents

Figure		Page
1	Superficial Cervical Region, Punctum Nervosum	2–3
2–9	Median Cervical Region, Sternocleidomastoid Region . . .	4–19
8–18	Carotid Triangle	16–37
10–12	Exposure of Common Carotid Artery	20–25
13–18	Carotid Triangle, Overall Structure, Anterior Approach to the Cervical Spine	26–37
19–28	Thyroid Region	38–57
27–29	Scalenovertebral Triangle	54–59
30–32	Lateral Cervical Region	60–65
33–34	Submandibular Triangle, Superficial Cervical Region	66–69
35–39	Parotid-Masseter Region	70–79
40–42	Lateral Facial Region, Temporal Region	80–85
43–45	Infratemporal Fossa	86–91
46–49	Approach to the Middle Meningeal Artery, Orbit and Temporal Region	92–99
50–51	Orbital Region	100–103
52–60	Occipital Region, Posterior Cervical Region, Suboccipital Puncture	104–121
61–63	Suprascapular Region, Posterior Cervical Region	122–127
64–68	Dorsum of the Thorax, Suprascapular, Interscapular and Scapular Region	128–137
69–74	Dorsum of the Thorax, Posterior Cutaneous Branches, Vertebrolumbar Region	138–149
75–77	Lumbar Puncture, Lumbar Region	150–155
78–85	Pectoral Region	156–171
86–95	Female Breast	172–191
96–107	Thoracic Cavity, Right Lung, Root of the Lung, Pulmonary Arteries, Left Lung	192–215
108–110	Posterior Mediastinum, Root of the Lung, Pulmonary Sulcus	216–221
111–113	Pericardium, Pericardial Cavity	222–229
114–122	Heart	230–247
115–117	Locating the Coronary Arteries	232–237
123–127	Infraclavicular Region	248–257
128–139	Axilla, Axillary Space	258–281
140–141	Arm and Axilla	282–285

Figure		Page
142–148	Arm, Posterior Brachial Region, Locating the Radial Nerve .	286–299
149–157	Anterior Cubital Region, Subcutaneous Veins, Superficial Fascia, Various Layers	300–317
158–164	Anterior Antebrachial Region, Various Layers	318–331
165	Anterior Carpal Region	332–333
166–173	The Hand, Palm of the Hand, Palmar Aponeurosis, Structure of the Finger, Carpal Tendon Sheaths	334–349
174–177	The Hand, Digital Tendon Sheaths	350–357
178–181	Posterior Antebrachial Region, Various Layers	358–365
182–183	The Hand, Dorsum of the Hand, Dorsal Digital Expansion .	366–369
184–188	Shoulder Joint, Puncture Sites	370–379
189–195	Elbow Joint, Collateral Ligaments, Puncture Sites	380–393
196–205	Joints of the Hand, Aspects, Carpal Joint Mechanics, Puncture Sites	394–413
	Index	415–430

Neck
Carotid Triangle
Thyroid Gland
Head
Salivary Glands
Temporal Region and Orbit

Suboccipital Puncture
Back
Lumbar Puncture

Thorax and Breast
Breast Contents
Axillary Cavity

Upper Arm
Elbow
Forearm
Hand

Shoulder Joint
Elbow Joint
Joints of the Hand

Figure 1**Superficial Cervical Region 1
Punctum nervosum**

A thin **superficial cervical fascia** invests the surface of the neck under cover of the outer skin, the **common integument**, and the **platysma**.

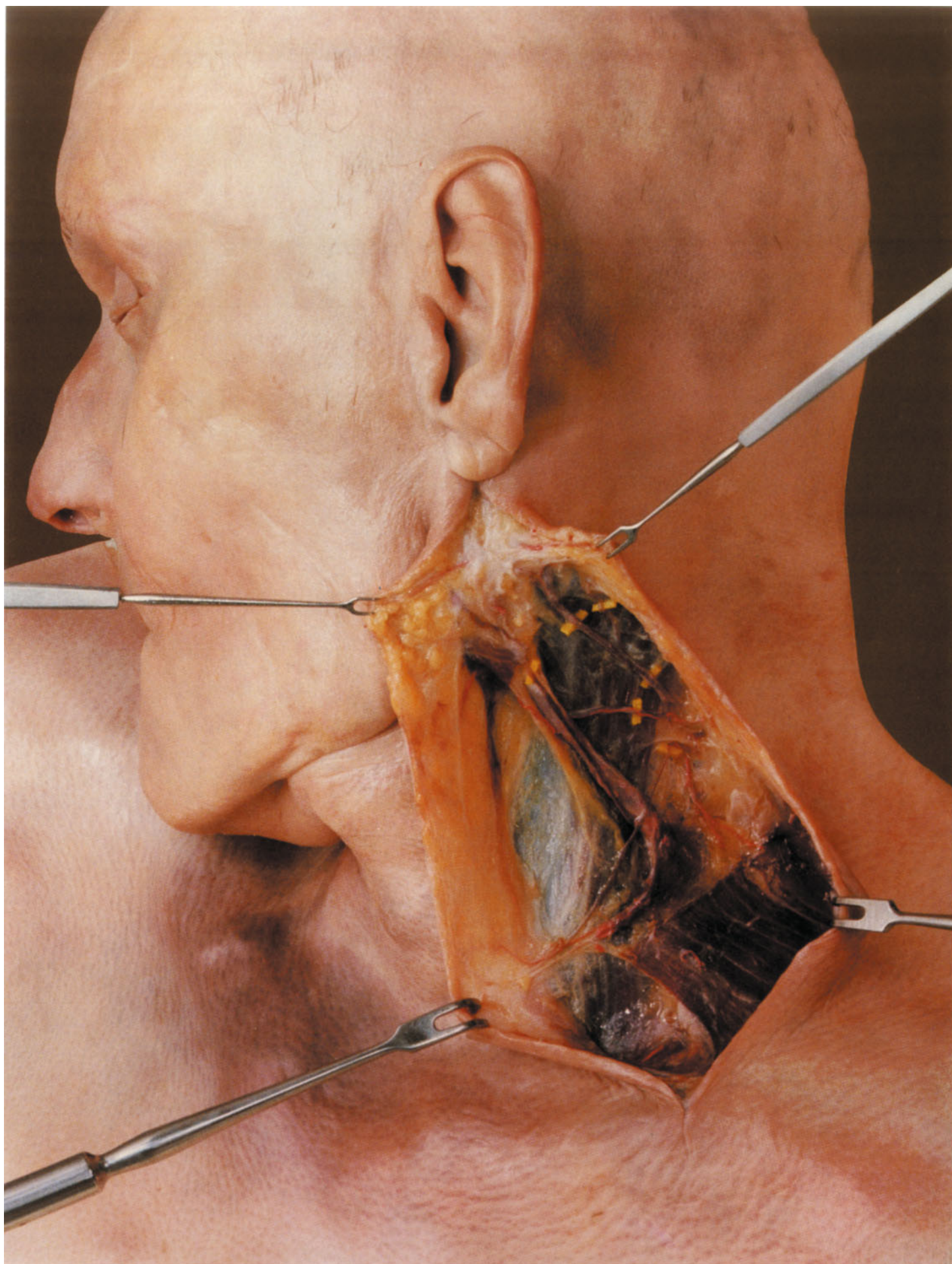
The **platysma** is a muscular sheet lying below the skin of the neck on the plane of the **subcutaneous tissue**, which elsewhere in the body may contain abundant fat. All of the deep surface of this plane is bounded by a fascia-like layer of connective tissue called the **deep layer of the stratum subcutaneum** (see Introduction in Volume I).

The **platysma** is bounded by a **connective tissue layer** on both its superficial and deep surfaces, the inner layer being considerably stronger than the outer layer. The connective tissue layer unites with the thin **superficial cervical fascia** to form a stronger layer that invests the cutaneous nerve trunks and major blood vessels. The portion of this layer in front of the **external jugular vein** has been preserved. Behind that vein, the portion corresponding to the **deep layer of the stratum subcutaneum** has been removed by sharp dissection to expose the cutaneous nerves of the **cervical plexus**, which become superficial at the **punctum nervosum**.

The **great auricular nerve**, which divides into an **anterior** and **posterior** ramus, is tagged. The **transverse cervical nerve** tracks toward the front, crossing below the **external jugular vein**.

The lower tagged nerve is a **medial supraclavicular nerve**, called also the **suprasternal nerve** because it passes to the skin over the manubrium sterni. The remaining supraclavicular nerves and lesser occipital nerve occupy a somewhat deeper plane and become superficial at some distance from the punctum nervosum (see Lateral Cervical Region).

The strip of fatty tissue that accompanies the **external jugular vein** is a typical structural feature of the **flat tunnels** described in the Introduction. Next to the external jugular vein is a **cervical branch** of the **facial nerve**. The **platysma** stumps define the area in which the muscle originally covered the vein.



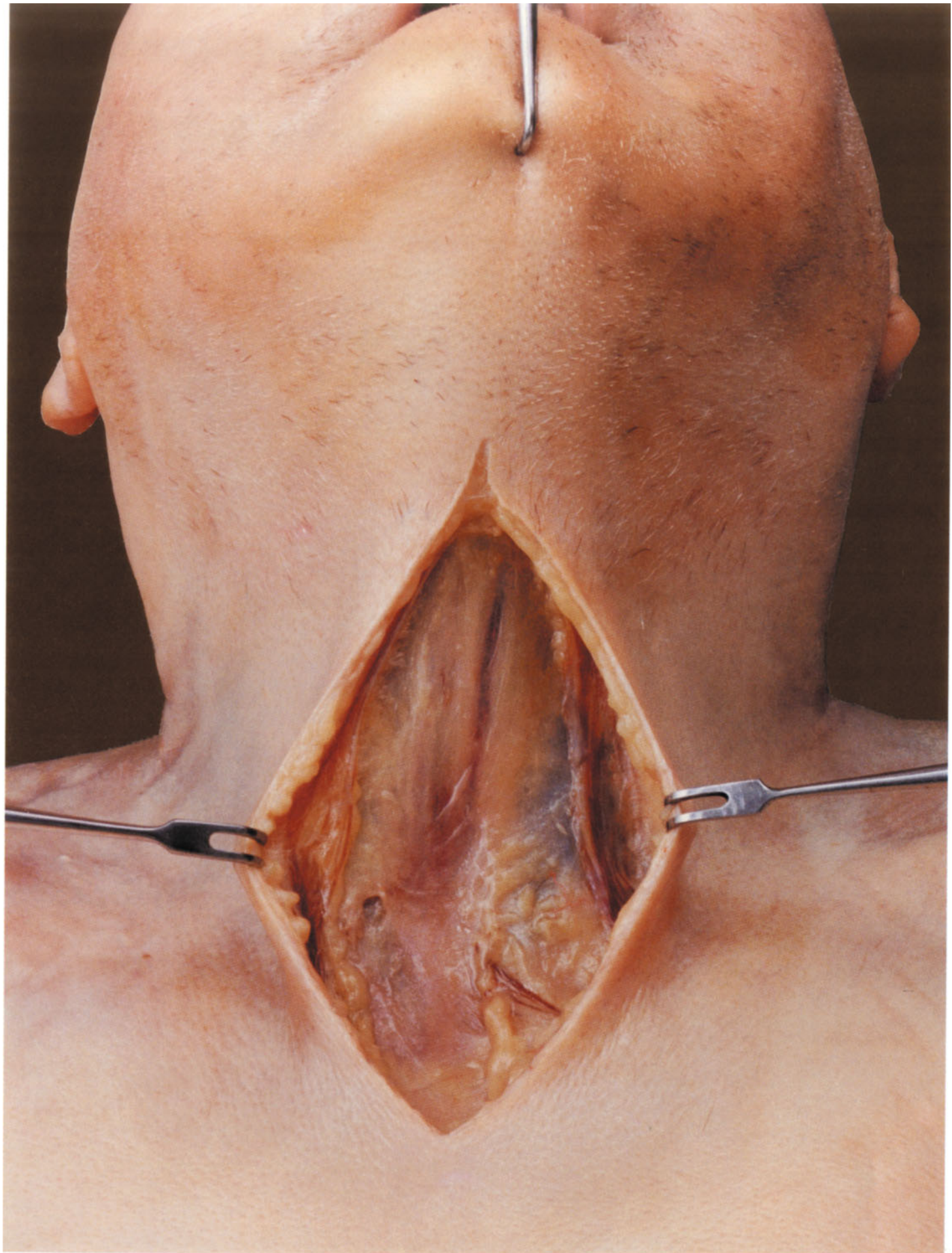
The **median cervical region** assumes practical importance as a site for surgical approaches to the trachea and larynx. It extends vertically from the **hyoid bone** to the **sternum** and is bounded laterally by the **omohyoid** and **sternocleidomastoid muscles**. It corresponds to the **anterior cervical region** minus the carotid, submandibular, and submental triangles and is defined by the two **omotracheal muscular triangles** that have a common base on the median plane.

The medial borders of the platysma diverge to uncover a gently widening median interval in which the **skin**, with its relatively thin layer of subcutaneous fatty tissue, directly overlies the **superficial cervical fascia**. The fatty tissue surrounding the borders of the platysma forms two prominent longitudinal folds in the lax skin of older individuals.

The **skin** in this specimen has been incised on the midline, dissected from the medial borders of the platysma, and retracted laterally with the **subcutaneous tissue**. Lateral to the platysma borders, the plane between the skin and platysma in the infrahyoid region contains little if any fat, even in well-nourished individuals, and consists only of a loose fibrous layer of connective tissue. The same applies to the deep surface of platysma.

The **sternohyoid muscle** is visible through the upper part of the exposed **superficial cervical fascia**, in an area where the superficial fascia is more closely applied to the middle cervical fascia. The **linea alba** of the neck is also faintly visible through the superficial fascia on the cervical midline.

Aberrant bundles of platysma are commonly found in the infrahyoid region, as in this specimen, and they are often bilateral.



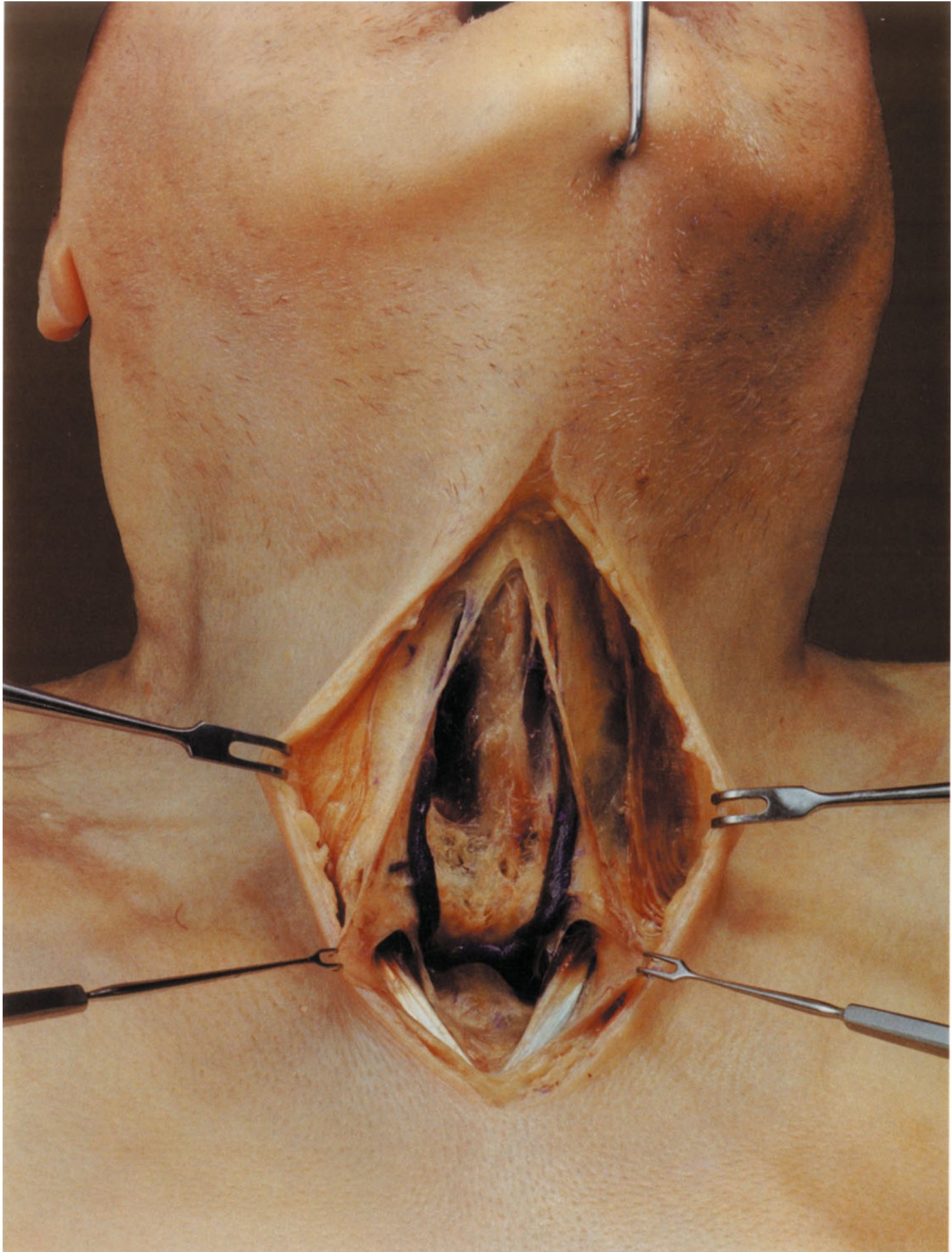
The **skin** and **subcutaneous tissue** have been incised on the midline, dissected from underlying tissues and retracted laterally, and the exposed **superficial cervical fascia** has been opened with a vertical midline incision and its edges retracted. The fascia splits at the **sternocleidomastoid** into layers that ensheath the muscle. This sheath has been opened close to the attachment of the muscle.

The incision of the superficial cervical fascia has opened the **suprasternal space**, which is filled with fibrofatty tissue. Inferiorly this space encompasses the full width of the jugular notch of the sternum and contains the **jugular arch**, which is of variable size. The same space contains both **anterior jugular veins**, which have been exposed somewhat higher through slits in the superficial cervical fascia. The space tapers superiorly to form a narrow cleft in which the superficial fascia is applied to the **middle cervical fascia**. This fascia and the embedded infrahyoid muscles form the entire posterior wall of the space.

The **sternohyoid** and other enclosed muscles are clearly visible through the thin overlying fascia, their fascial sheaths blending in the median plane to form a narrow, pale stripe called the **linea alba** of the neck.

In the lower part of the suprasternal space, a remnant of connective tissue left behind the jugular arch obscures vision of the posterior wall of the space.

The **jugular arch** interconnects the sites where the anterior jugular veins drain into the subclavian veins or the junction of the subclavian and internal jugular veins.

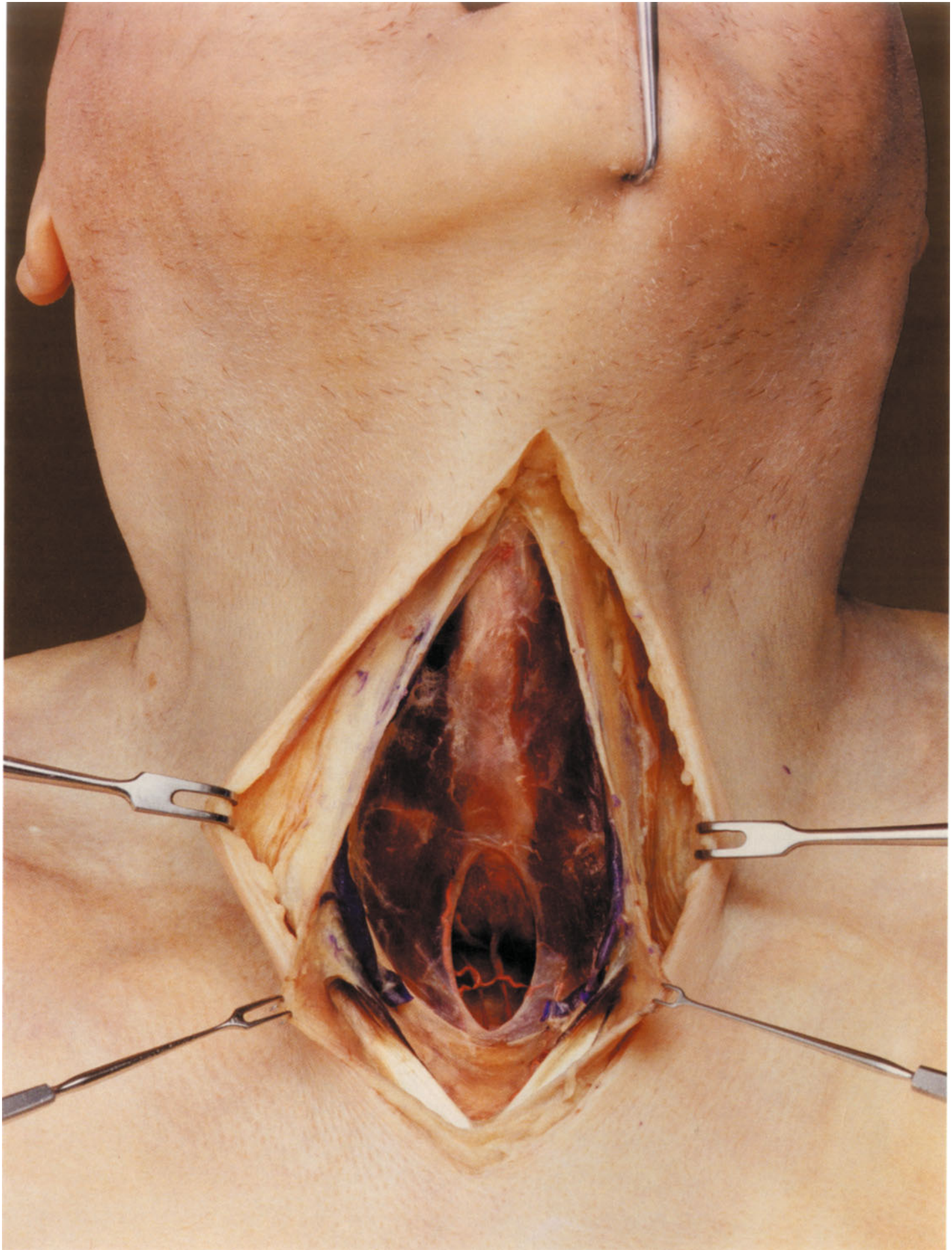


The skin and superficial cervical fascia are retracted as before, the jugular arch has been resected, and the contents of the **suprasternal space** have been removed. The entire posterior wall of the space can now be seen along with the upper end of the sternum with its **jugular notch** and, behind it, the attachment of the **middle cervical fascia** with the embedded **infrahyoid muscles**.

The middle cervical fascia in the lower part of the **linea alba** has been divided on the median plane, opening the **pretracheal space**. The loose fibrofatty tissue has been removed to expose the **trachea** in the depths of the space. The **tracheal cartilages** should always be palpated and identified before a **tracheotomy** without division of the thyroid isthmus is performed to avoid confusing the trachea with a highly and anteriorly placed brachiocephalic trunk.

The **thyroid gland isthmus** is visible in the upper half of the elliptical opening. Descending from the isthmus are the **inferior thyroid veins**. These veins may be combined into a single trunk, and their calibers increase several-fold when venous congestion occurs. A somewhat uncommon **thyroid ima artery** is present in this specimen.

The **sternohyoid muscles** are covered only by a very thin portion of the **middle cervical fascia**. But their **tendinous intersections** are often united with one another, as here, by a strong connective tissue band from the linea alba. Thicker fascia covers the **sternothyroid muscles**, which overlap the sternohyoids medially in the lower part of the field.



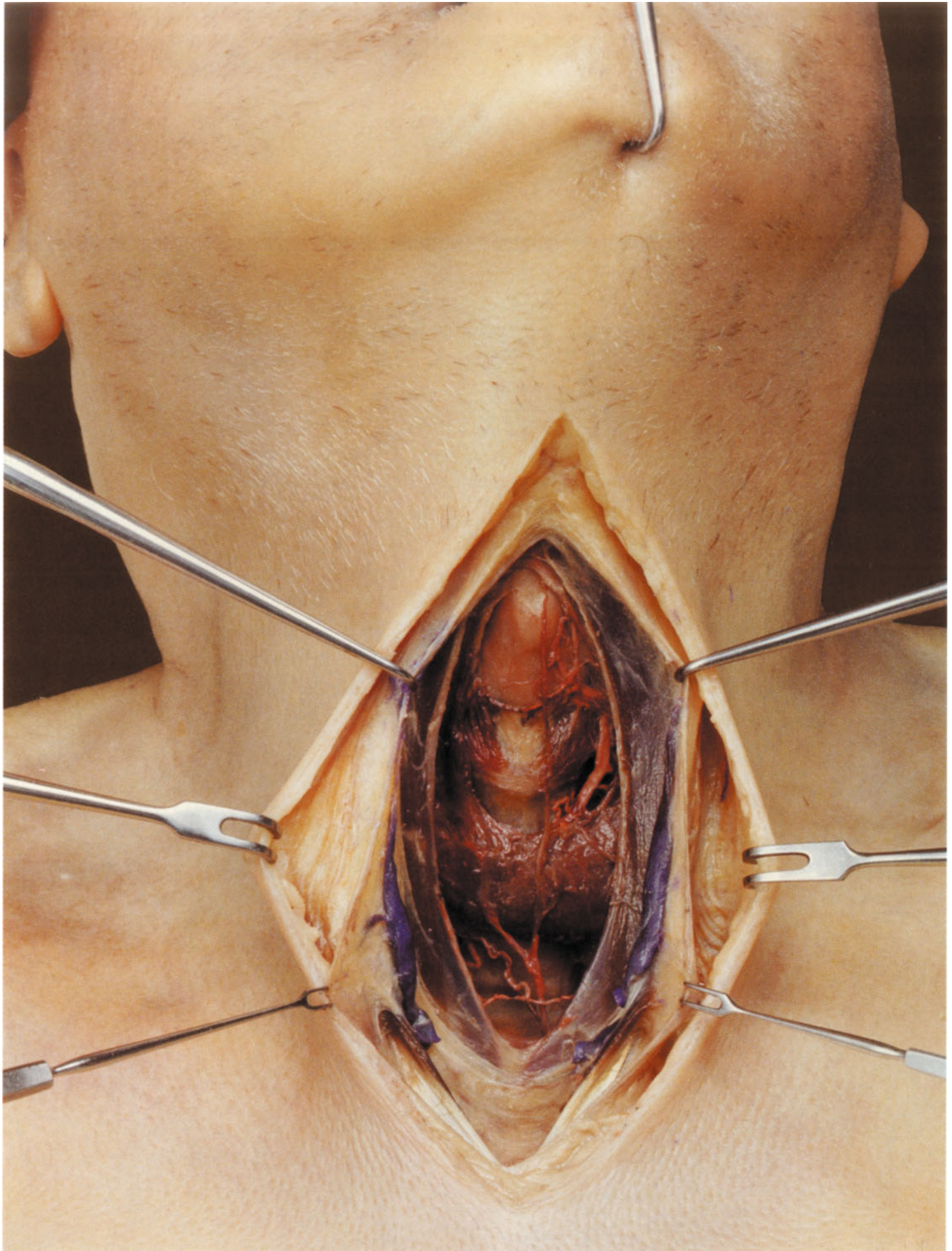
From the same approach as in the previous figure, the posterior wall of the **suprasternal space**, the **middle cervical fascia**, has been incised for its full length on the midline and retracted with the superficial cervical fascia, opening up the **pretracheal space**. Loose connective tissue has been removed from this space to expose the thyroid gland isthmus and, above it, the anterior aspect of the larynx.

A **tracheotomy** without division of the thyroid isthmus is performed in the upper part of the trachea at a distance of about 2 cm from the skin surface. A **low tracheotomy** is performed just below the jugular notch of the sternum at about twice that distance from the skin.

The **pyramidal lobe** that occasionally ascends from the thyroid isthmus does not occupy a typical central location but is shifted to the right, where it comes in contact with the **cricothyroid muscle**. The **conus elasticus** stretching between the thyroid cartilage and cricoid cartilage and strengthened medially by the anterior cricothyroid ligament is exposed as for a **coniotomy**. The **cricothyroid branch** of the superior thyroid artery and its accompanying veins normally cover the conus elasticus near the thyroid cartilage. Usually this branch does not interfere with the coniotomy, which is performed transversely to keep the incision patent.

The **inferior thyroid veins** have united to form one vessel, the thyroid ima vein, which in this specimen opens into the left brachiocephalic vein.

The veins at the thoracic inlet all pose a risk of **air embolism** when injured. This particularly applies to the **anterior jugular veins**, which usually are kept from collapsing by their secure attachments to the cervical fasciae.



This figure shows the muscles of the median cervical region in an undistorted condition. Most of the **fascial layers** have been removed. Only remnants of the superficial cervical fascia have been left on the **sternocleidomastoid muscle**, which the fascia ensheaths (seen clearly at upper right), and on the **sternothyroid muscle**, which is still covered by the middle cervical fascia.

The **sternohyoid muscles** arise from the bony surfaces about the **sternoclavicular joint**, converge superiorly, and insert into the **body** of the **hyoid bone** in close proximity to each other. The right muscle displays the usual **tendinous intersection** along with a rare intermediate tendon at the level of the oblique line of the thyroid cartilage.

The **sternothyroid muscles** diverge as they ascend. They are contiguous or even overlapping at their origin from the upper posterior surface of the **manubrium sterni** and first rib cartilage and are attached to the **oblique line** of the **thyroid cartilage**. The sternohyoid muscles cover much of the sternothyroids, leaving exposed an inferior triangular area that extends to the median plane and, in this specimen, is still covered by a portion of the middle cervical fascia that is thicker than the anterior fascia of the sternohyoid muscle. A consistent **tendinous intersection** is visible through the fascia on the left side.

Lateral to the sternohyoid muscle is the **superior belly** of the **omohyoid muscle** with its attachment to the **body** of the **hyoid bone**. It forms the boundary between the median cervical region and the carotid triangle.



This figure shows the median cervical region at maximal exposure. The **sternohyoid muscle** has been elevated and retracted laterally to demonstrate the second layer of **infrahyoid muscles**. The exposed posterior surface of the sternohyoid is still covered by fascia.

The **sternothyroid muscle** on the right side has been somewhat more widely exposed. The muscle passes over the bulge of the **right lobe** of the **thyroid gland** before inserting on the oblique line of the thyroid cartilage. The **oblique line** starts at the **inferior thyroid tubercle**. Past the oblique line, the **thyrohyoid muscle** forms a short upward continuation of the sternothyroid.

Retraction of the sternohyoid muscles provides a better overall view of the thyroid gland. This specimen features a rather large, right-sided **pyramidal lobe** covering the cricothyroid muscle and continuing as a connective-tissue strand that attaches to a large infrahyoid **accessory thyroid gland** and contains several small islands of thyroid parenchyma. This structure is the rudiment of the **thyroglossal duct**.

The main branch of the **superior thyroid artery** may course outside the **sternothyroid muscle**, as on the left side, or it may be covered by it as on the right side.

Another striking feature is an inconstant **communicating vein** between the inferior and superior thyroid veins, which passes over the front of the **thyroid gland isthmus** and forms a very long vertical connection linking the multiple anastomoses of the two venous territories.

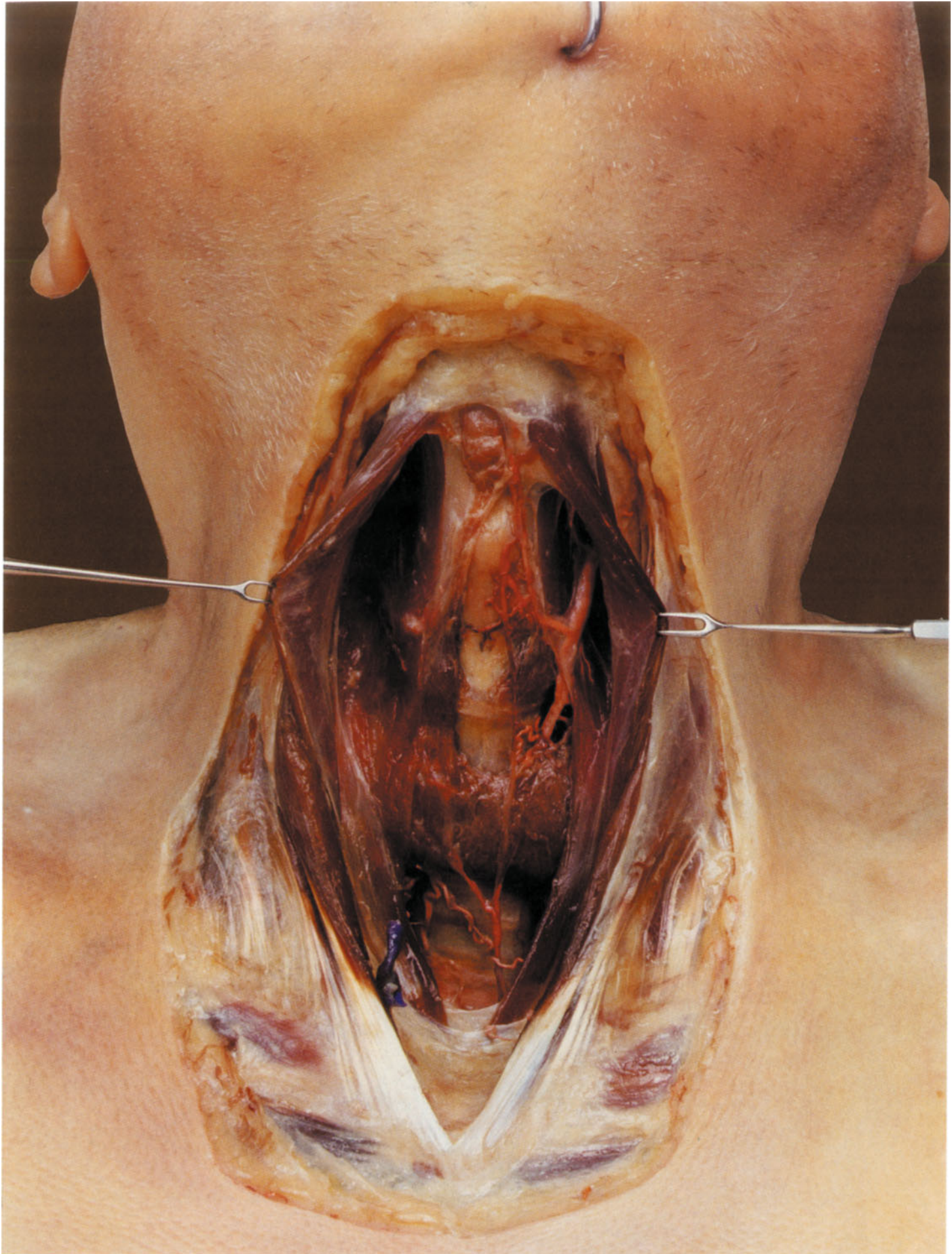


Figure 8**Median Cervical Region 7
Sternocleidomastoid Region 1
Carotid Triangle 1**

The **median cervical region** is unchanged relative to the previous figure, but this more oblique exposure gives a better impression of the depth of the trachea relative to the surface of the neck. It also demonstrates the relation of the median cervical region to the **sternocleidomastoid region** and **carotid triangle**.

The **sternocleidomastoid region** has been exposed by retraction of the **sternocleidomastoid muscle**, which otherwise covers more of the lower part of the **sternohyoid muscle**, the portions of the **omohyoid muscle** bordering on the intermediate tendon, and the **middle cervical fascia** stretching between the omohyoid muscles. At a higher and more lateral level, the sternocleidomastoid muscle lies upon the **lobe** of the **thyroid gland** and the portion of the **neurovascular bundle** that runs laterally past the gland. The superior pole of the thyroid gland usually reaches the carotid triangle.

Above the sternocleidomastoid region and lateral to the median cervical region is the **carotid triangle**. It is bounded by the **superior belly** of the **omohyoid muscle**, the **sternocleidomastoid muscle**, and the **posterior belly** of the **digastric muscle** covered by the cervical lobe of the parotid gland.

As in the median cervical region, the **carotid triangle** has been freed of skin, platysma, and superficial cervical fascia, leaving only a narrow strip attached to the deep layer of the sternocleidomastoid muscle fascia between the midcervical and sternocleidomastoid regions. This enabled wide lateral retraction of the **sternocleidomastoid muscle** following division of a **sternocleidomastoid branch** of the **superior thyroid artery**. The **fibrofatty tissue** and embedded **deep cervical lymph nodes** have been removed from the **carotid triangle**, chiefly by blunt dissection, and the neurovascular bundle with its **carotid sheath** is exposed.

The **carotid sheath** encloses the **common carotid artery** and is continued at branching points into the adventitia of the branching vessels. It blends with the adventitia of the **internal jugular vein** to form a common connective-tissue investment of the neurovascular bundle, in which the common carotid artery, with the adjoining **ansa cervicalis**, is clearly visible.

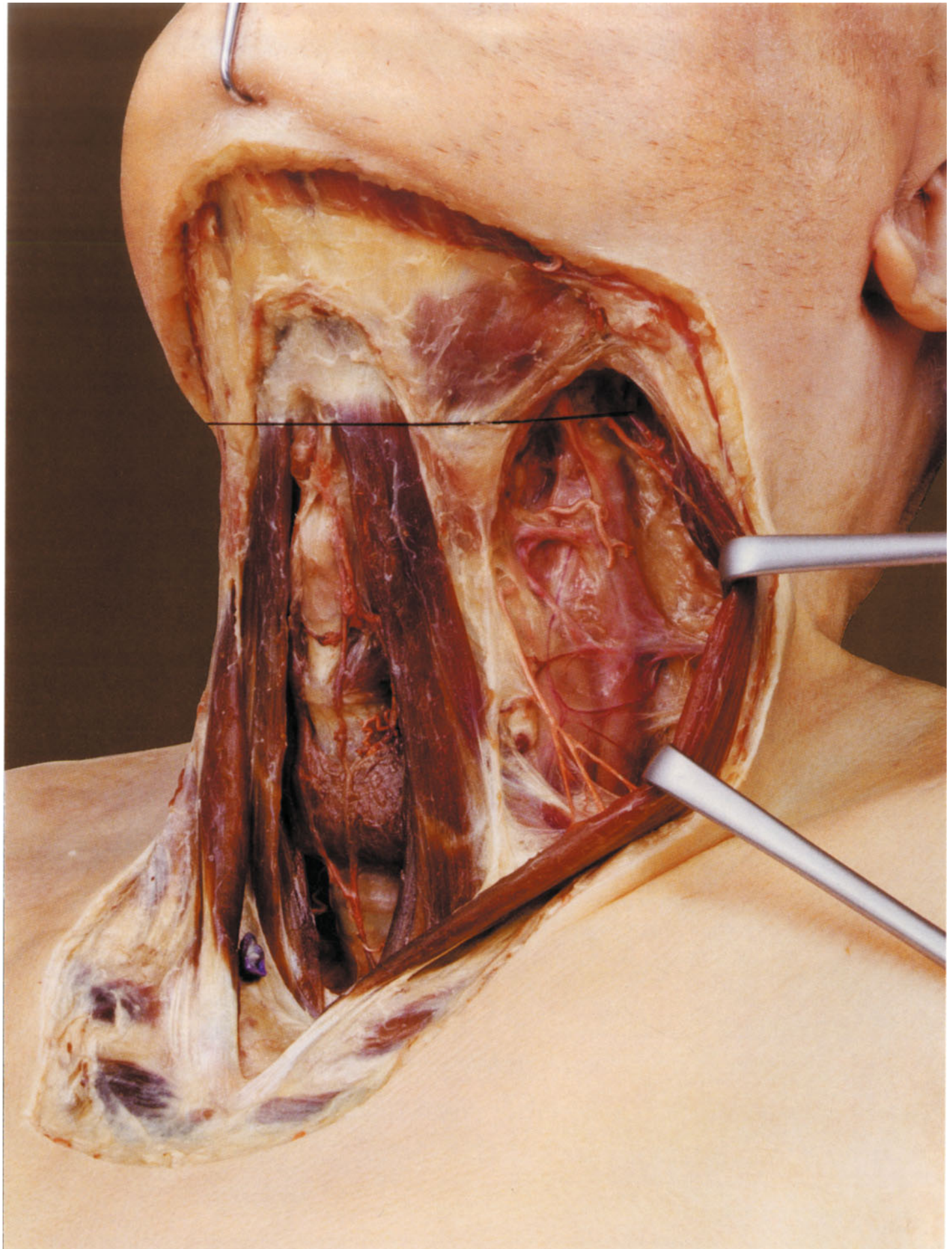


Figure 9**Median Cervical Region 8
Sternocleidomastoid Region 2
Carotid Triangle 2**

The **larynx** and **trachea** have been incised on the midline and partially opened with retractors. The components of the **thyroid cartilage** and the **trachea** are more easily retracted than the **arch** of the **cricoid cartilage**.

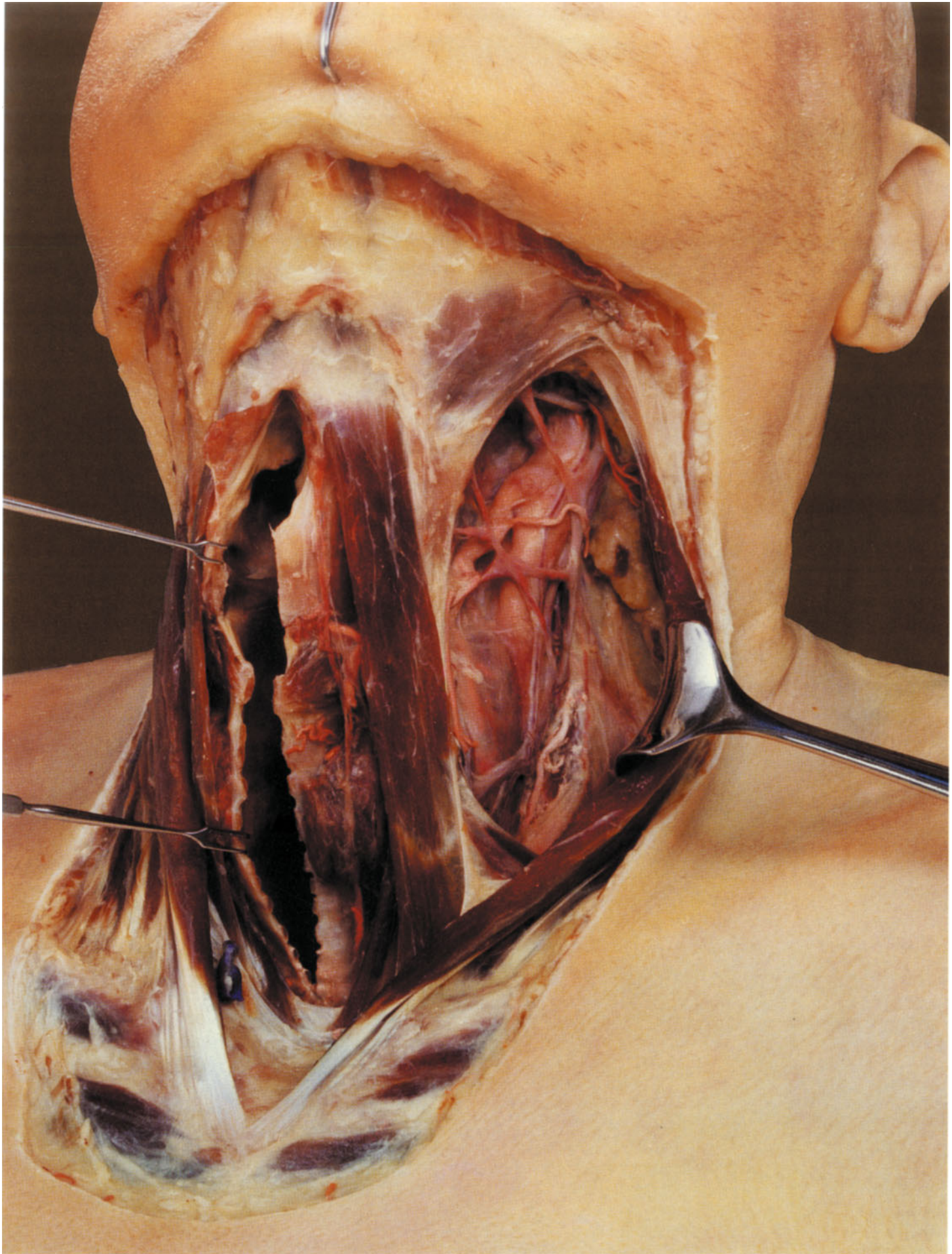
The **thyroid gland isthmus** has been divided to illustrate the relative positions with and without division of the thyroid isthmus. Also, the divided larynx clearly demonstrates the position and depth of a **coniotomy**.

The **vocal fold** (vocal cord) and **vestibular fold** (ventricular fold) are clearly visible within the larynx. The **laryngeal ventricle** (of MORGAGNI) appears as a lateral out-pouching between the vocal and vestibular folds. Higher up is the **laryngeal aperture**, bounded by the **epiglottis** (divided just off the midline) and the **aryepiglottic fold**.

Lateral to the left sternohyoid muscle with its tendinous intersection is the **omohyoid muscle** with its superior and inferior bellies. The **sternocleidomastoid muscle** has been widely retracted to expose the **left lobe** of the **thyroid gland** lateral to the infrahypoid muscles. The thyroid lobe is still covered by its **fibrous capsule** and overlaps the neurovascular bundle of the neck. Its superior pole reaches into the visible carotid triangle.

The central structure of the **carotid triangle** is the **common carotid artery** with its point of division, the **carotid bifurcation**. The **superior thyroid artery** is usually the first vessel to branch from the common carotid artery, arising below the origin of the **external carotid artery**. It is accompanied by the superior thyroid vein, which in this case forms a common trunk with the lingual vein termed the **thyrolingual trunk**. The **internal jugular vein** almost always has a relatively small caliber on the left side.

The carotid triangle is filled with fibrofatty tissue in which the **deep cervical lymph nodes** are embedded. A piece of this fatty tissue has been left in place near the sternocleidomastoid muscle.

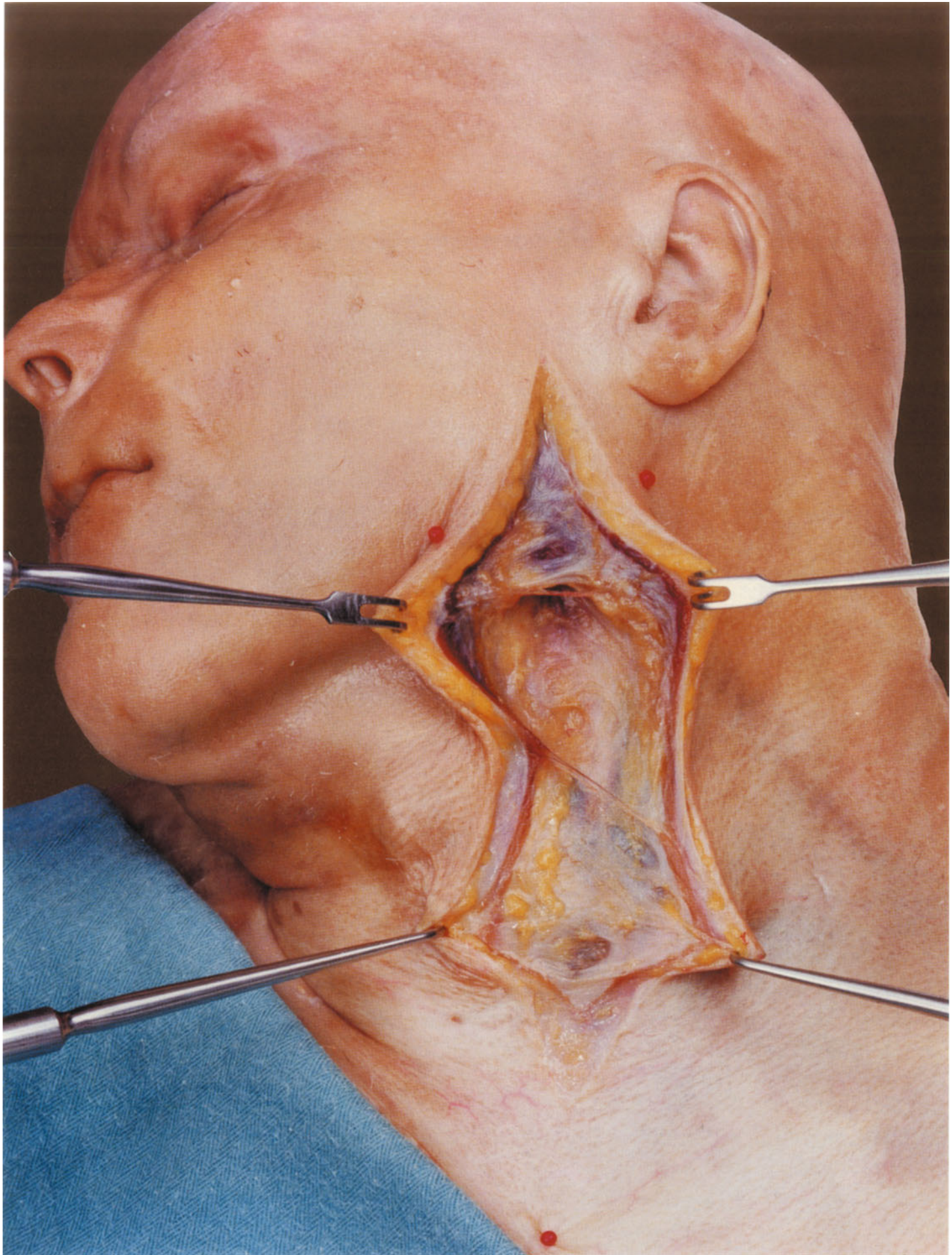


Most surgical procedures in the **carotid triangle** are performed with the head turned to the opposite side. While this shifts the **sternocleidomastoid muscle** farther over the neurovascular bundle of the neck, the muscle is easily retracted laterally when freed from the **superficial cervical fascia**, providing good exposure of the carotid triangle.

In this position the **carotid arteries** lie on a projected line passing from the center of the retromandibular fossa to the sternoclavicular joint. Consequently the skin incision starts between the palpable bony prominences of the **mandibular angle** and **mastoid process** (marked by red pinheads) and is carried toward the **sternoclavicular joint**. It cuts the anterior border of the **sternocleidomastoid muscle** at a very shallow angle.

The **platysma** has been divided with the skin and **subcutaneous tissue** and dissected aside. Visible in the upper angle of the skin incision is the firm **parotid fascia**, which blends inferiorly with the **dense connective tissue** on the deep surface of the platysma. This layer is actually part of the **deep layer of the stratum subcutaneum** and blends at the sternocleidomastoid muscle with the **superficial cervical fascia**. In the carotid triangle, however, a thin **fat pad** separates this layer from the superficial fascia, which passes upward on the deep surface of the **parotid gland**, creating a **flat tunnel** enclosing the **cervical branch** of the **facial nerve** and the connecting branch of the **external jugular vein** (see Introduction in Vol. I).

A thick **subcutaneous fatty layer** intervenes between the skin and platysma only in the upper portion of the platysma and may produce a **double chin** in the **submental region**. But dense connective tissue covers all of the outer surface of the platysma and, together with the fascia-like layer on the platysma deep surface, constitutes the **deep layer of the stratum subcutaneum** in which the platysma is embedded.



The **parotid fascia** has been removed from the cervical lobe of the parotid, and the **superficial cervical fascia** has been incised and retracted with the skin-platysma flap. The posterior soft-tissue flap follows the course of the **sternocleidomastoid muscle**.

The **connective tissue** in the space of the carotid triangle and the **deep cervical lymph nodes** embedded within it have been dissected off the small-caliber vessels and pushed aside.

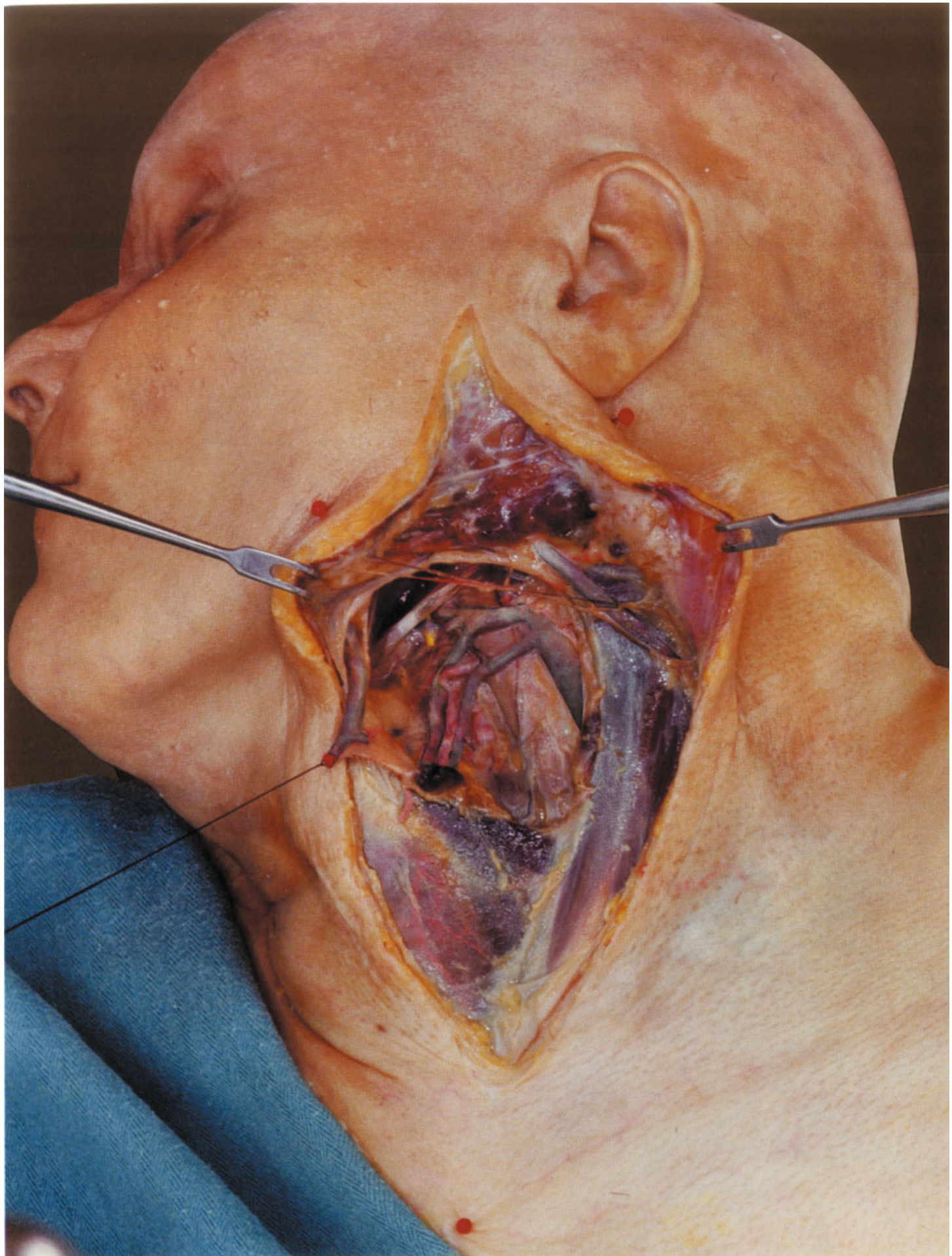
Large **veins** draining the region of the thyroid gland, tongue, and face cross in front of the large arterial vessels. They may drain separately into the internal jugular vein as the **thyroid vein**, **lingual vein**, and **facial vein**, or they may unite in various ways to form one or more common **trunks** before entering the jugular. In the present case, the veins unite to form a common **thyrolinguofacial trunk**.

The **facial vein** has been sectioned and drawn aside at its entry into the trunk. In most cases this vein unites with the **retromandibular vein** to form a **common facial vein**, which enters the internal jugular vein at the site where the common trunk terminates in this specimen. In the angle above that site, the **jugulodigastric node**, often markedly enlarged, is in contact with the **internal jugular vein**. This node is important, as it transmits a large share of the lymph drainage from the head; Most called it the “principal gland” of the deep cervical lymph nodes.

The **superior thyroid artery**, accompanied by two veins, is the first vessel to branch from the **external carotid artery**. Both the **common** and **external carotid arteries** are still enclosed within the transparent **carotid sheath**.

The **thyroid gland** is slightly enlarged and produces a marked bulge in the outer contour of the neck. With the head so positioned, this modest **goiter** displaces the neurovascular bundle slightly off the standard line connecting the center of the retromandibular fossa with the sternoclavicular joint.

The anterior soft-tissue flap has been widely retracted from the mandibular angle to expose the **digastric muscle** with its intermediate tendon (defining the upper boundary of the **carotid triangle**) and the adjacent **deep cervical lymph nodes**.



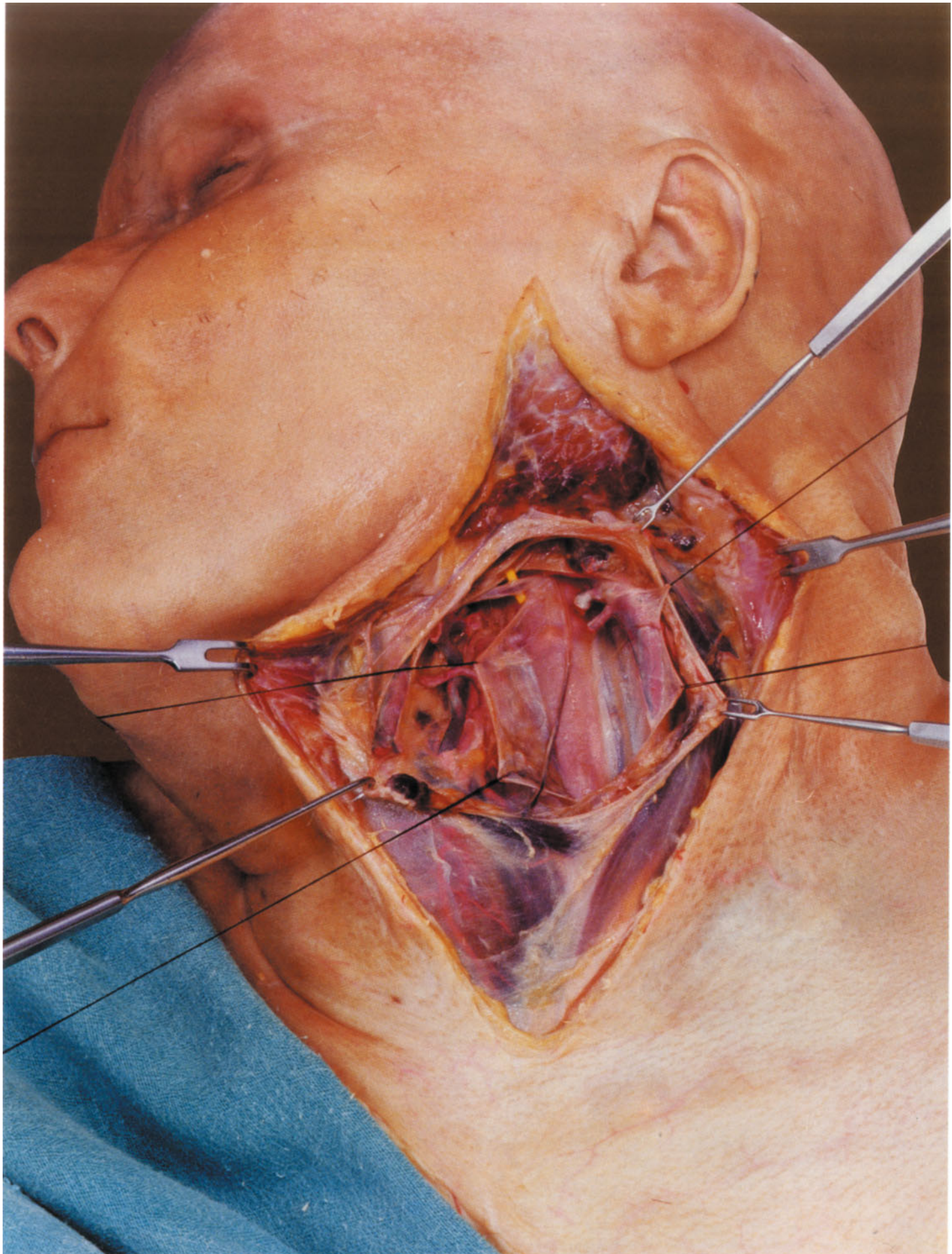
The **parotid fascia** has been removed from the lower part of the **parotid gland**, and its continuation with the platysma has been reflected to demonstrate the **infraauricular lymph nodes** and a **superficial cervical lymph node**. A second lymph node is visible next to the anterior infraauricular node, and both are embedded in the glandular parenchyma in typical fashion.

MoST assigns all of these nodes to the **superficial cervical lymph node group**, also applying the term “**infraauricular glands**” to this region. But these nodes not only receive lymphatic drainage from the external ear but also help drain a large skin area extending from the upper lip across the nose and eyelids to the scalp at the vertex of the head.

The approach to the large vessels of the neck is the same as in the previous figure, except that the incised **superficial cervical fascia** has been retracted further, and more posterior retraction has been placed on the **sternocleidomastoid muscle**. The **jugulodigastric node** still adjoins the **internal jugular vein** at the upper edge of the field, and the transected **facial vein** leaves the front of the incised submandibular compartment after crossing superficial to the submandibular gland within the compartment.

The **thyrolinguofacial trunk** formed by the union of the **thyroid, lingual, and facial veins**, which crosses in front of the **carotid bifurcation**, has been sectioned before its entry into the internal jugular vein and reflected. The second **thyroid vein** has also been sectioned.

The **carotid sheath** has been longitudinally incised over the common carotid artery to the level of the **carotid bifurcation** and the edges retracted with threads. The **anterior root of the ansa cervicalis** can be seen within the sheath, and the **vagus nerve** is visible through its posterior wall between the internal jugular vein and common carotid artery.



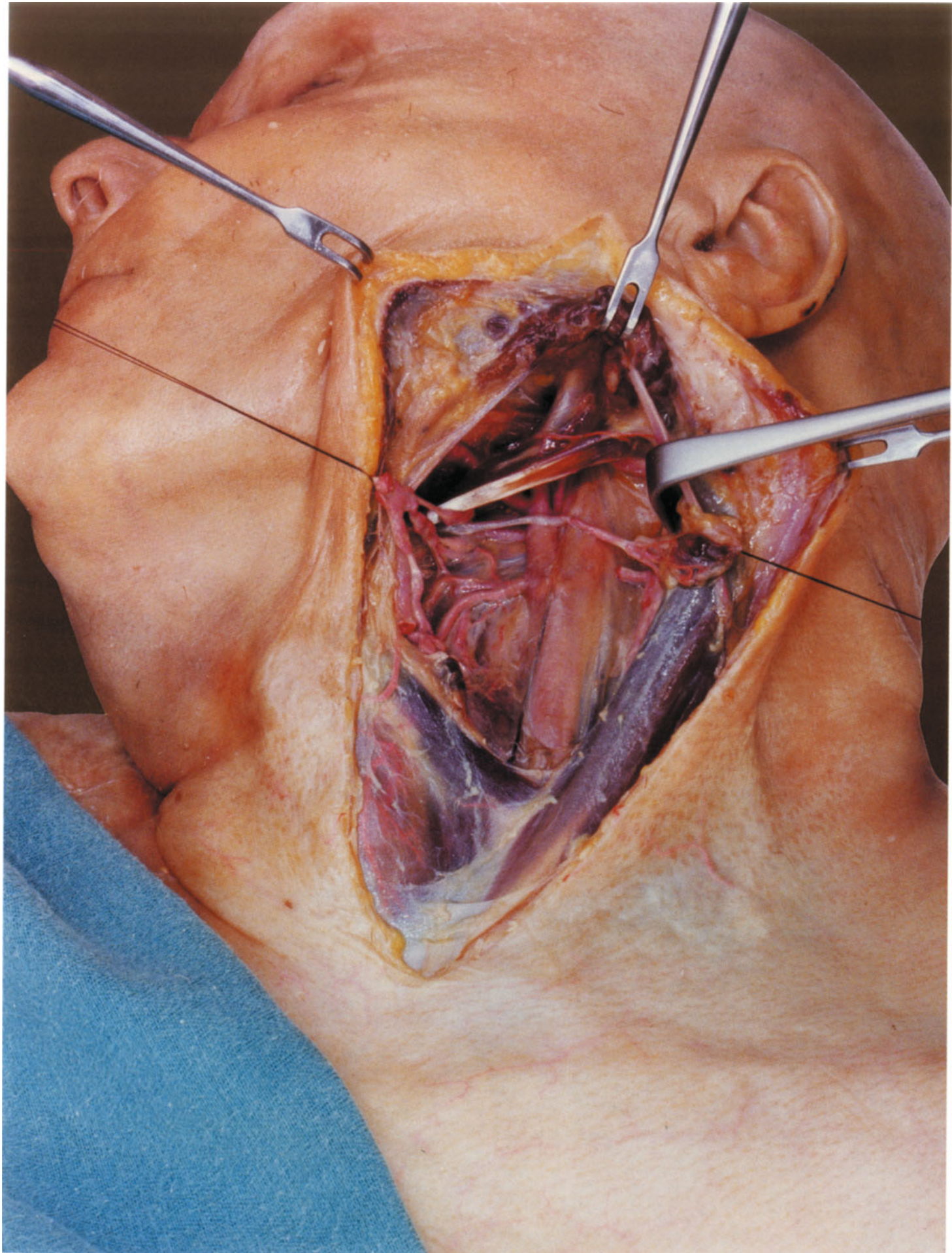
The approach is the same as in the previous figure, but the **parotid gland** has been dissected from its very loose attachment to the posterior belly of the **digastric muscle** and retracted upward, exposing almost all of the upper boundary of the carotid triangle and the entry of the **external carotid artery** into the **retromandibular fossa**.

The portion of the **superficial cervical fascia** attached to the mandibular angle, called the **angular tract**, passes to the deep surface of the **parotid gland** and continues into its very thin internal capsule. Below the parotid, the **deep layer of the stratum subcutaneum** is initially separate from the superficial cervical fascia as a continuation of the **parotid fascia**, as described in Fig. 9. This layer shows a similar arrangement at the anterior border of the sternocleidomastoid, where it forms a **flat tunnel** that transmits the **anterior jugular vein**.

Leaving the carotid triangle, the **external carotid artery** and its two visible branches, the **facial** and **occipital arteries**, are crossed by the **stylohyoid muscle** and the posterior belly of the **digastric muscle**. Just below that level, the **hypoglossal nerve** also crosses over the external carotid after first giving off the **anterior root** of the **ansa cervicalis** and, medial to the intermediate digastric tendon, turns toward the tongue.

The **sternocleidomastoid artery**, a constant branch of the external carotid, loops over the **hypoglossal nerve** in typical fashion. It supplies the homonymous muscle along with the sternocleidomastoid branch of the superior thyroid artery and enters the muscle in company with the accessory nerve.

The **lingual artery** and **superior thyroid artery** also arise from the front of the external carotid artery and may form a common trunk. The proximity of the branching vessels to one another depends on the level of the **carotid bifurcation**. Usually this level is at the **center** of the **carotid triangle**, as in this specimen, but it may be placed closer to its upper or lower boundary. The numerous branching vessels help to distinguish the external carotid artery from the internal carotid artery.



Through the same approach used to locate the **common carotid artery**, the **superficial cervical fascia** has been removed out to the boundaries of the carotid triangle. The head has been hyperextended to place tension on the **sternocleidomastoid muscle** and expose all the arteries of the carotid triangle in an undisplaced condition. The **common carotid artery** is continuous superiorly with the **internal carotid artery**. Both vessels lie on the line connecting the points of the **retromandibular fossa** and **sternoclavicular joint** that have been marked with red pinheads.

The **carotid sheath** has been removed from the **common carotid artery**. Past the carotid bifurcation, the sheath blends with the adventitia of the branching vessels. A traction thread marks a remnant of this **adventitia** on the **internal carotid artery**.

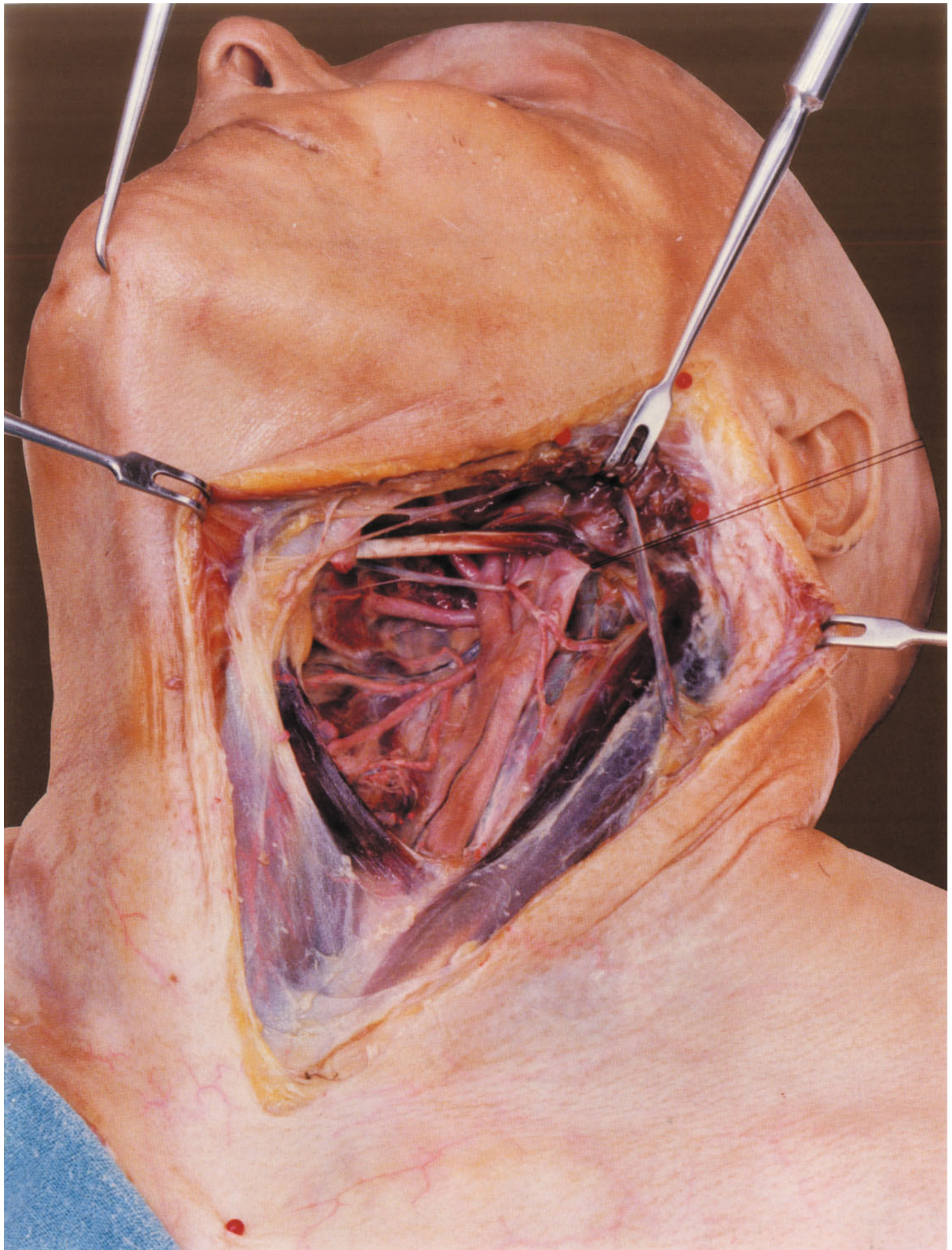
The **internal carotid artery** commences with a slight dilatation, the **carotid sinus**. The external and internal carotid arteries may assume various relative positions in the area of the **carotid bifurcation**.

In this specimen the **internal carotid artery** occupies a “typical” position behind and lateral to the external carotid artery. But, as HUEBNER notes, a purely posterior position is almost as common, and a posteromedial position is not unusual. The further course of the internal carotid artery is also variable, and coiling may occur. A coiled internal carotid artery that closely approaches the pharynx and tonsillar fossa is susceptible to injury during tonsillectomies.

The slight distortion of the internal carotid artery in this dissection makes it appear that the **hypoglossal nerve** runs between the two carotid arteries, but in reality it has already crossed the unexposed portion of the internal carotid artery.

The **visceral tract** is visible in the anterior part of the **carotid triangle**. The **lingual artery** disappears medial to the **hyoglossus muscle**, while the **hypoglossal nerve** continues on before passing beneath the intermediate tendon of the **digastric muscle**.

The **superior laryngeal artery** is accompanied by the dark-colored internal branch of the **superior laryngeal nerve**, while the external branch is in contact with the **superior thyroid artery**.



Continuing with the dissection in the preceding figures, the head has been turned fully to the opposite side, and the **sternocleidomastoid muscle** has been retracted posteriorly beneath the terminal part of the **great auricular nerve**, exposing a deep tendinous expansion. Below it, the **accessory nerve** and **sternocleidomastoid artery** enter the muscle. The **accessory nerve** has entered the carotid triangle by crossing the internal jugular vein medially rather than laterally, which is relatively common.

The **carotid bifurcation** has been pulled forward by its tunica adventitia and rotated to display its medial aspect and the **carotid body**.

The **hypoglossal nerve**, which originally lay between the **internal carotid artery** and **internal jugular vein** in contact with the **vagus nerve**, crosses over the internal carotid artery and leaves the carotid triangle in a flat arch, passing medial to the intermediate tendon of the **digastric muscle**.

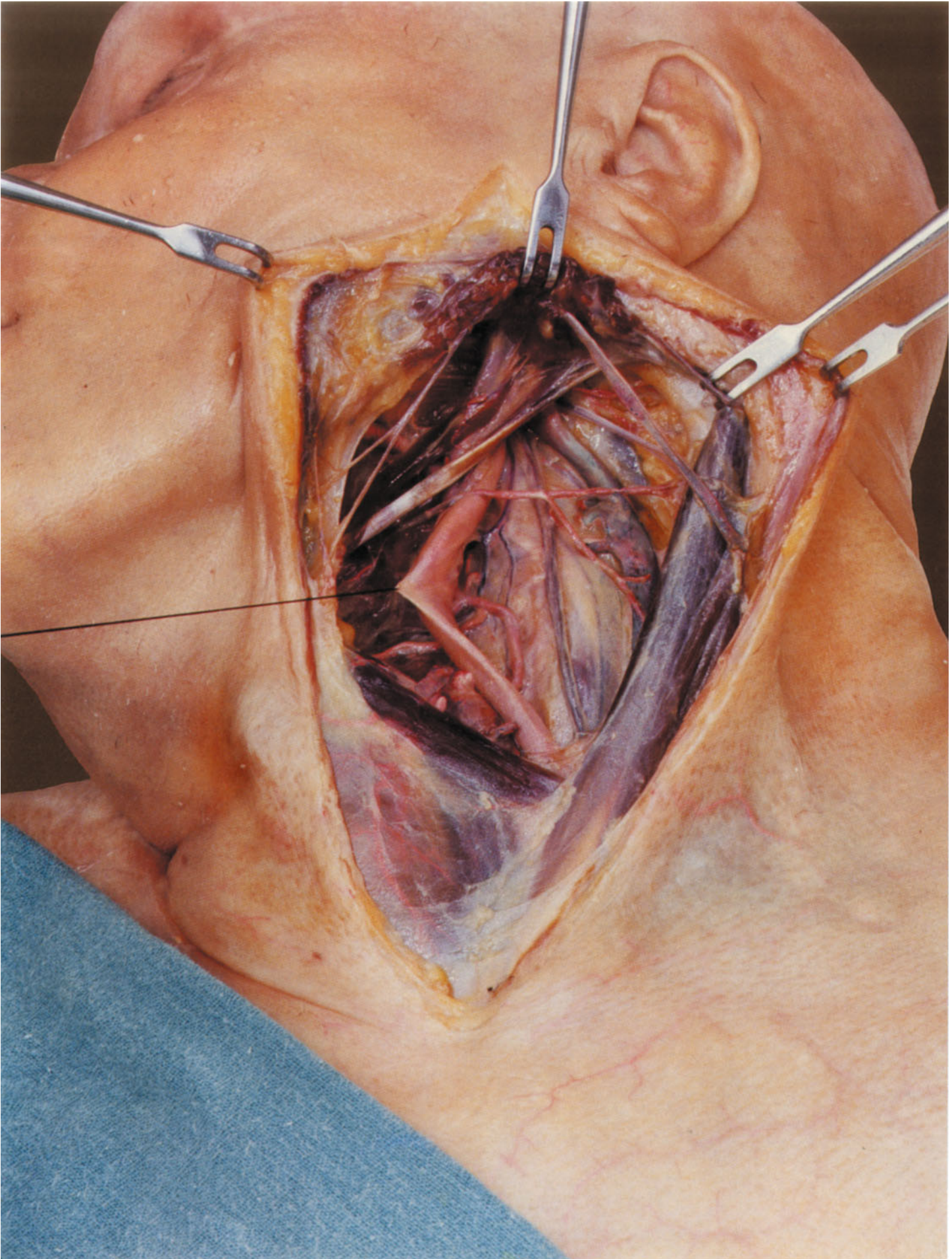
The displacement of the great vessels does not affect the **vagus nerve**, which has been dissected out of the connective tissue enclosing the neurovascular bundle of the neck and lies freely on the plane of the **deep cervical fascia**.

The **vagus nerve** contains a discolored nerve fascicle derived from the accessory nerve. This part of the **accessory nerve** is called the **pars vagalis**.

The **superior laryngeal nerve**, a branch of the vagus, divides into an **internal branch** and an **external branch** within the carotid triangle. The external branch relates closely to the **superior thyroid artery**. The fascia-enclosed **sympathetic trunk** is visible through the **deep cervical fascia** at the border of the **longus capitis muscle**.

Visible above the **digastric muscle** are the **stylohyoid muscle** and **styloglossus muscle**, between which the **external carotid artery** enters the retromandibular fossa medial to the parotid gland. Its relation to the internal carotid artery can be appreciated by tracing the course of the vessel.

The **retromandibular vein** and the **cervical branch** of the facial nerve are seen emerging from the elevated **cervical lobe** of the **parotid gland**.



Within the **carotid triangle**, it is relatively easy to retract the **neurovascular bundle** medially away from the cervical spine once the **internal jugular vein** has been isolated from the **sternocleidomastoid muscle**. The dissection proceeds through a loose fibrofatty layer that contains numerous lateral **deep cervical lymph nodes** in this area. The **sternocleidomastoid artery** and the **sternocleidomastoid branch** of the **superior thyroid artery** usually have to be divided as well.

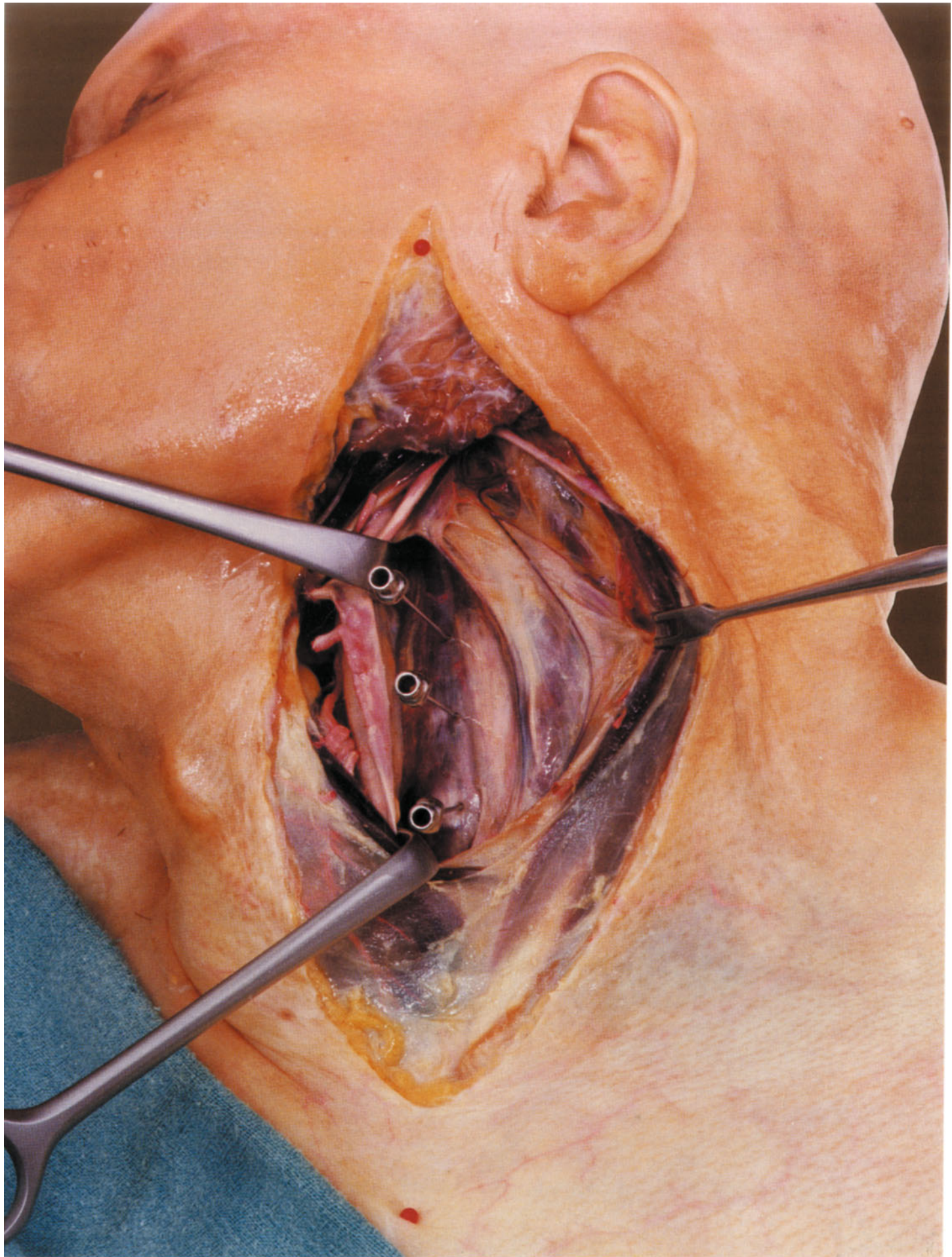
The ansa cervicalis is formed by the union of its anterior and posterior roots, which may occur at various levels. When the ansa is centrally placed, its posterior root appears in the field of the dissection.

When the **deep cervical fascia** has been reached, the **neurovascular bundle** with its **intercarotid fascial layer** can be bluntly mobilized and displaced medially. The **prevertebral muscles**, consisting of the **longus colli** and **longus capitis**, are now visible behind the transparent **prevertebral layer** of the **deep cervical fascia**.

The **longus colli muscle** covers the front of the cervical vertebral bodies and is attached to them. Its medial portion, which LUSCHKA calls the **rectus colli**, is particularly strong and muscular in this specimen. Like its lateral portions, it is almost always covered by long tendons, and the fleshy parts of the muscle leave a relatively broad interval that gives access to the **anterior longitudinal ligament** on the median plane.

The **longus capitis** is attached at its lower end to the **carotid tubercle**, the anterior tubercle of the transverse process of the sixth cervical vertebra. The **sympathetic trunk** runs along its anterior border and the **posterior root** of the **ansa cervicalis** along its posterior border. This root receives its final contribution from the **third cervical nerve**, which emerges between the longus capitis and scalenus medius muscles.

The sites for puncture of the **intervertebral disks** between the fourth and seventh cervical vertebrae are shown.



The **gross appearance** of the **carotid triangle** is very diverse due to normal variations and depends further on whether the neck is short and plump or, as in this case, long and slender.

The **right carotid triangle** was chosen in this specimen to provide a natural transition to the head dissections, which were performed on the right side. Adjacent regions have also been dissected to demonstrate the **boundaries** of the **carotid triangle** (described previously) with optimum clarity.

The dominant structure of the exposed visceral tract is the **right lamina** of the **thyroid cartilage**, which fuses with the opposite lamina to form a conspicuous **laryngeal prominence** (Adam's apple) in this male cadaver. Lateral to the prominence is a corresponding indentation in the carotid triangle that may appear as a contour depression in thin individuals.

Stretching from the upper border of the thyroid cartilage plate to the **greater cornu** of the **hyoid bone** is the **thyrohyoid membrane**, on which runs the tagged **internal branch** of the **superior laryngeal nerve**. The **thyrohyoid muscle**, adjoining the larynx, is visible behind the border of the **omohyoid muscle**, and behind the thyrohyoid is the origin of the **inferior pharyngeal constrictor muscle**.

The **internal jugular vein** is markedly collapsed in this specimen, and the **carotid sheath** enclosing the **common carotid artery** has been preserved only in the lowest portion of the carotid triangle.

The position of the **carotid bifurcation** is somewhat unusual in that the **internal carotid artery** lies medial to the **external carotid artery** and not behind it. This relationship is present throughout life and does not develop secondarily due, for example, to an age-related longitudinal growth spurt of the anterior arteries. This natural rotation of the carotid bifurcation provides a lateral view of the **carotid body**, which has been dissected free.



Starting with the exposure in the previous figure, the entrance to the retromandibular fossa has been more widely exposed by removal of the parotid gland.

The full length of the **external carotid artery** is now visible as far as the origin of its two terminal branches. It crosses the posterior belly of the **digastric muscle** and the **stylohyoid muscle** on their medial side after first giving off the **occipital artery** posteriorly and the **facial artery** anteriorly. It is accompanied atypically by its own branch of the maxillary vein, which drains into the **internal jugular vein** through a **pharyngeal vein**.

The **sternocleidomastoid artery**, which loops around the **hypoglossal nerve** as usual, consists here of two branches. With the retraction on the sternocleidomastoid muscle, the artery has transformed the normal gentle curve of the hypoglossal nerve into a sharp angle.

The **superior laryngeal nerve**, which runs medial to all branches of the common carotid artery, has split into its two branches, each of which is engaged with a traction thread. The external branch, which distributes filaments to the pharynx and the **cricothyroid muscle**, runs close to the **superior thyroid artery** and is vulnerable during thyroid operations.

The **carotid sheath** has been split open, and the collapsed **internal jugular vein**, still adherent to the sheath, has been elevated with two threads. This vein is an extremely thin-walled structure that often reaches 2 cm in diameter on this side when filled with blood. The **vagus nerve**, embedded in delicate connective tissue, is visible between the internal jugular vein and **common carotid artery**. The tagged **accessory nerve** passes beneath the upper end of the vagus nerve in typical fashion. The **ansa cervicalis** is tagged at the lower end of the nerve.

The atypical configuration of the **carotid bifurcation** was described in the previous figure.

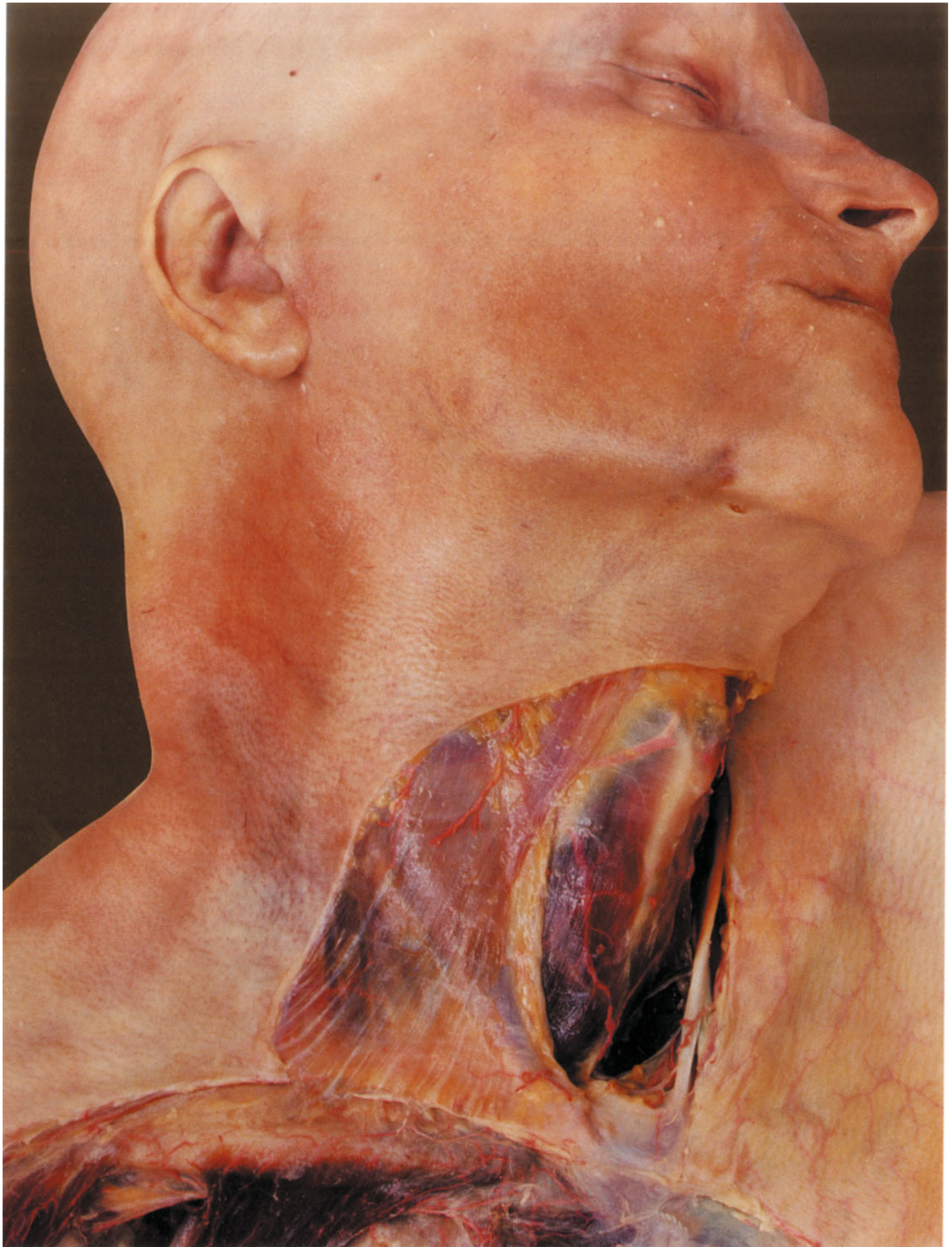


The **thyroid region** should not be construed as a subdivision of another region but simply as the region about the thyroid gland. The **thyroid gland** itself is not confined to the median cervical region, where it was previously described, but, depending on its size, may extend a variable distance laterally beneath the sternocleidomastoid muscle, placing part of the gland within the **sternocleidomastoid region**. The superior pole of its lateral lobe usually lies in the **carotid triangle**, which not only contains a portion of the thyroid gland but also provides the gland with much of its neurovascular supply.

The thyroid region has no formal bearing on the superficial anatomy of the neck, but it is instructive to demonstrate and describe the gland from a superficial approach.

The skin and subcutaneous tissue over the thyroid region have been removed. The typical bulge of the **sternocleidomastoid muscle** is visible in the lower part of the **sternocleidomastoid region**. Most of this muscle is covered by platysma, which has been resected inferiorly to expose the **clavicle**.

The **superficial cervical fascia** in the **median cervical region** has been removed, and the medial border of the opposite **sternocleidomastoid muscle** has been exposed, widely opening the **suprasternal space**. The contents of this space have been removed to demonstrate its posterior wall with the **linea alba** of the neck and the **sternohyoid muscle** embedded in the **middle cervical fascia**. Two small, fascia-covered veins pass to the cervical midline from the **anterior jugular veins** to form the **median vein** of the neck. This vein drains into the **jugular arch**, which is poorly developed in this specimen.



The **sternocleidomastoid muscle** arises by two heads in the lower part of the sternocleidomastoid region. The **medial** or **sternal head** arises from the anterior surface of the manubrium sterni by a flattened tendon that quickly gives way to a rounded muscle belly as it ascends. The **lateral** or **clavicular head** is broad and flat and arises from the superior border of the clavicle. It blends with the deep surface of the sternal head to form a fairly uniform muscle mass.

Above the **sternoclavicular joint**, the two heads of the sternocleidomastoid are separated by an interval that, in thin individuals, is marked by a skin depression, the **lesser supraclavicular fossa**. The **greater supraclavicular fossa** is lateral to the clavicular head.

With its oblique course, the sternocleidomastoid muscle overlaps much of the lower part of the thyroid gland, making the gland difficult to palpate when the muscle is tense.

The **superficial cervical fascia**, which also covers the sternocleidomastoid muscle, has been removed from the field to demonstrate the posterior wall of the **suprasternal space**, consisting of the middle cervical fascia and the embedded **infrahyoid muscles**.

This very thin layer directly covers the **thyroid gland**, and a well-developed thyroid should form a protrusion that indicates the location of the gland. The **linea alba** of the neck is flanked by the visible **sternohyoid muscles**. The superior belly of the **omohyoid muscle** is also seen. Fascia also covers the **anterior jugular vein** and its thin connection with the **median vein of the neck**.

The **suprasternal space** is bounded laterally by the connection of the middle cervical fascia with the deep fascia of the sternocleidomastoid muscle.



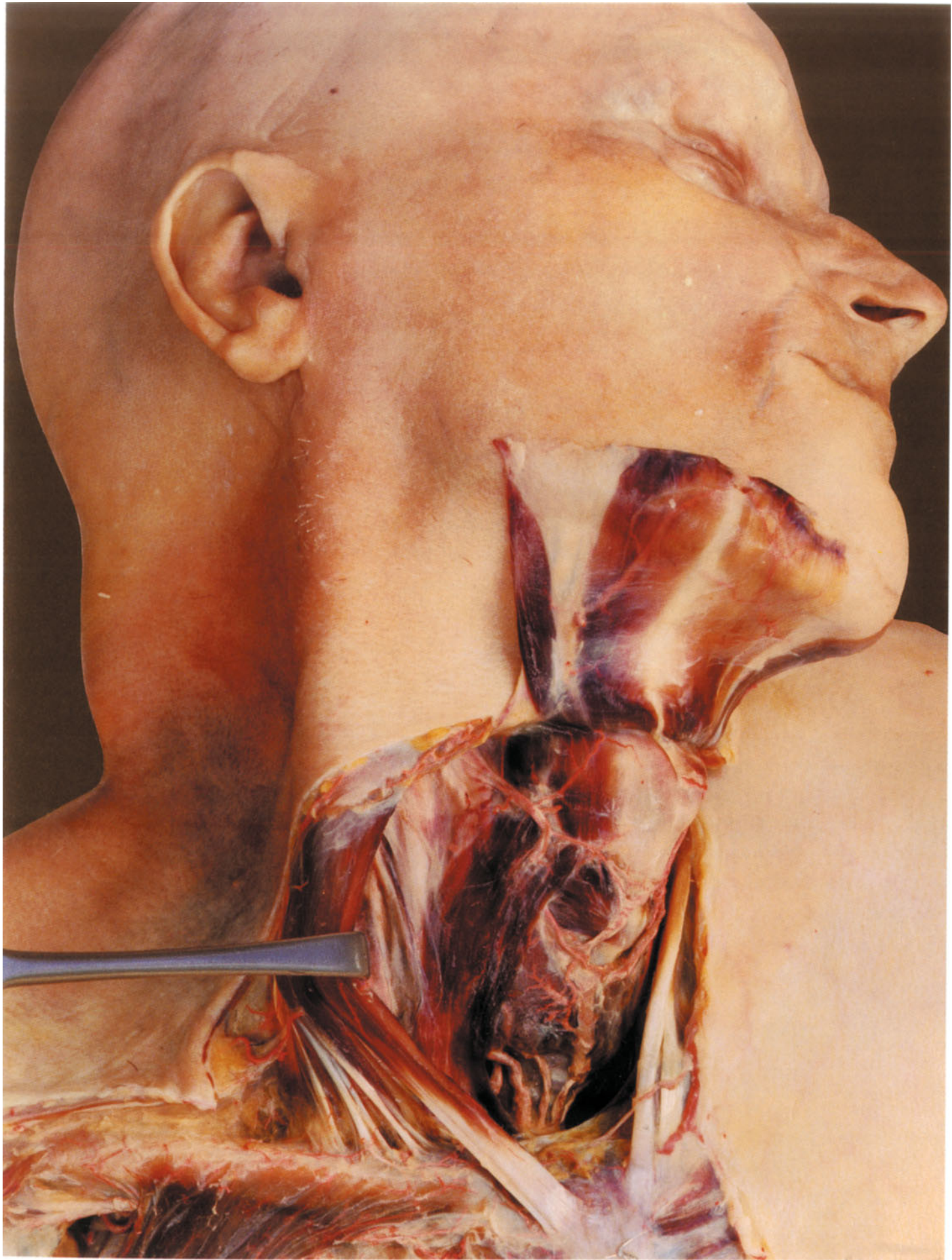
The **middle cervical fascia** stretching between the omohyoid muscles has been sectioned near its attachment along with the embedded anterior infrahyoid muscles, carrying the cut behind the sternocleidomastoids, and the flap has been reflected upward.

This thin sheet and the intact sternothyroid muscle separate the **suprasternal space** from the **pretracheal space**, which reaches upward to the larynx. There the **middle cervical fascia** and its muscles become applied or adherent to the **thyroid cartilage**.

The **sternothyroid muscle** covers a large portion of the thyroid gland and is continued upward as a muscle of equal width, the **thyrohyoid**. The very large anterior branch of the **superior thyroid artery** with its vein often courses between the sternothyroid and thyrohyoid muscles, running approximately along the **oblique line** of the thyroid cartilage. The anterior branch usually joins with the branch of the opposite side at the superior border of the **isthmus**. This specimen shows only a thin arterial trunk from which the **cricothyroid branch** arises, accompanied by a relatively large vein.

The **pretracheal space** contains the **isthmus** of the **thyroid gland**. Actually it forms a true space only below the level of the isthmus, where it is filled with loose fatty tissue and the **inferior thyroid veins**. Usually these veins unite to form two veins or a single vein at the **unpaired thyroid plexus**.

The **sternocleidomastoid muscle** has been retracted laterally along with the **neurovascular bundle**. The **longus colli muscle** is visible through the **deep cervical fascia**, to which several transected bundles of the **sternothyroid muscle** are attached.



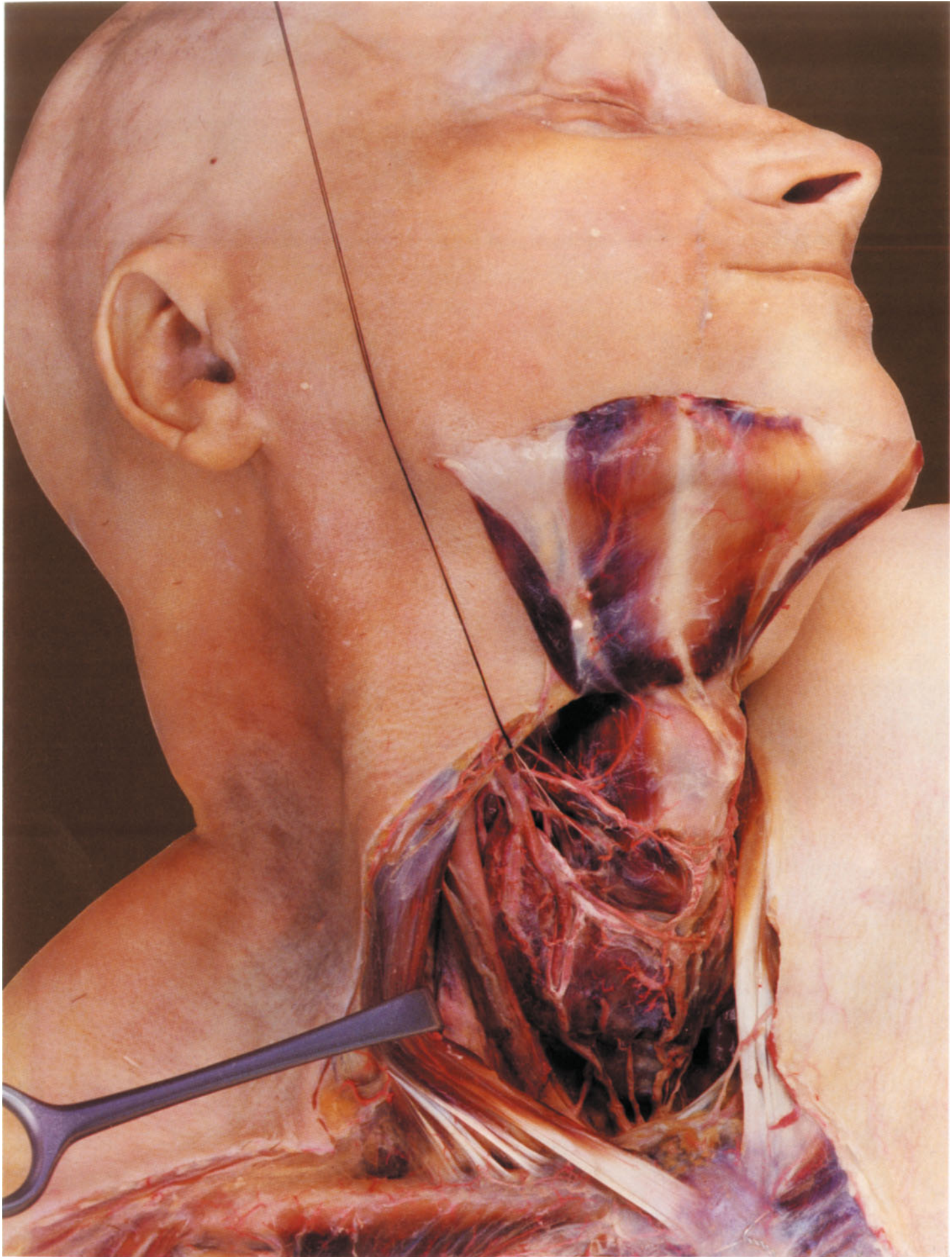
Here the **sternothyroid muscle** has also been resected and the **vessels** supplying the upper pole of the **right lobe** of the **thyroid gland** have been dissected free.

Besides the **isthmus**, the entire **right lobe** of the **thyroid gland** can be seen owing to retraction of the sternocleidomastoid muscle. Enclosing the gland is a semitransparent **fibrous capsule**, below which long segments of large-caliber vessels can be seen. The largest vessels about the gland are applied or adherent to the fibrous capsule.

The **superior thyroid artery** divides near the upper pole of the lobe into three visible branches: the anterior, lateral, and posterior. The **anterior branch**, which also may follow the cricothyroid branch and thus may lie above the **sternothyroid muscle**, reaches the gland behind the sternothyroid and is accompanied medially by a large vein. The **external branch** of the **superior laryngeal nerve**, engaged with a thread, runs close to the superior thyroid artery. Its branch to the **cricothyroid muscle**, which tenses the vocal folds, has been isolated along with the delicate branches to the **pharyngeal muscles**.

The **isthmus** is crossed centrally by a large **vein** that is fed in part by the **cricothyroid veins** in front of the conus elasticus. This vein unites inferiorly with the **unpaired thyroid plexus**, which is very well developed in this specimen.

The **common carotid artery** has maintained its relation to the gland despite the retraction of the **sternocleidomastoid muscle**. It is covered by a detached bundle of the **sternothyroid muscle** that terminates at the carotid sheath and was not included in the resection.



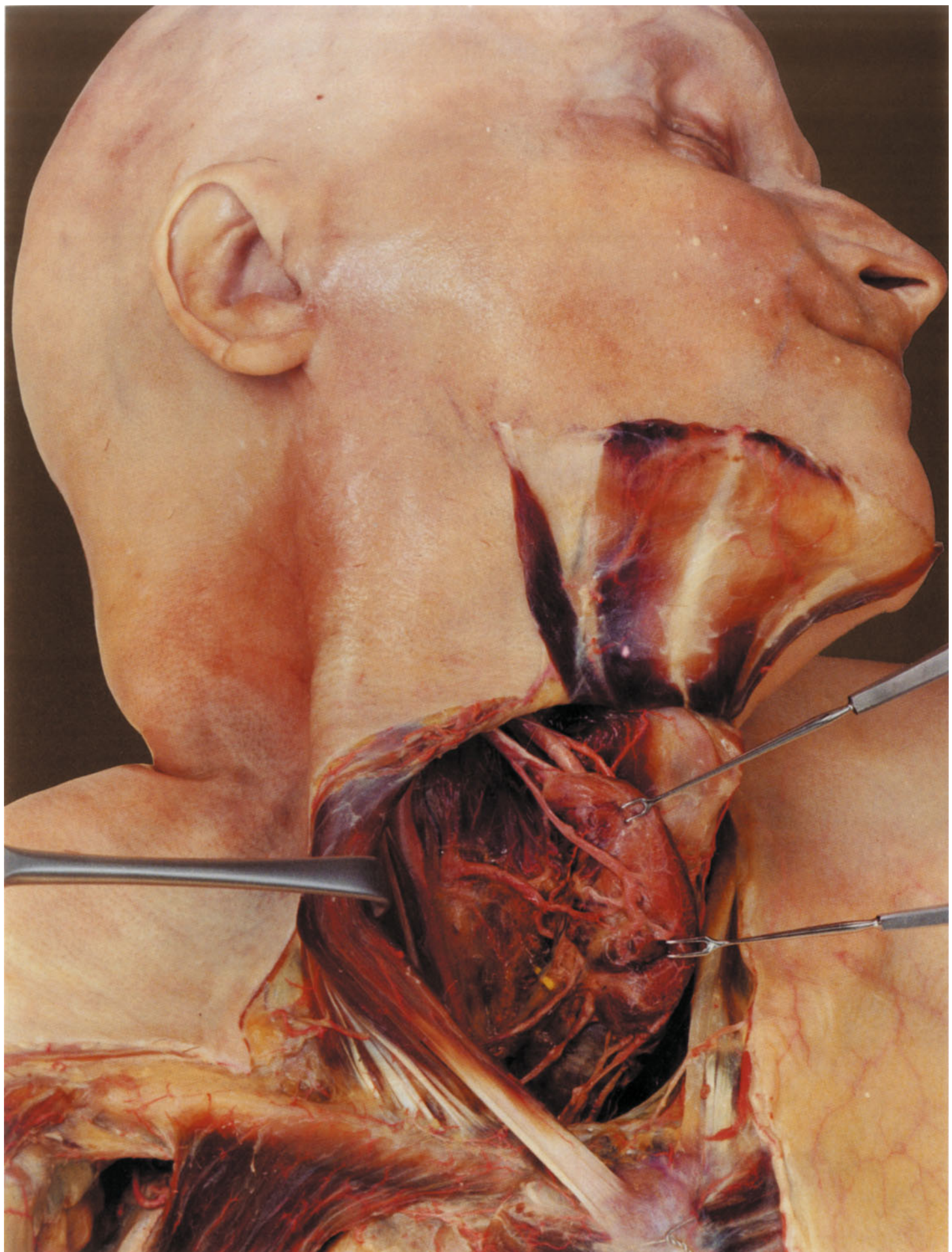
The **bed** of the **thyroid gland** consists of a **connective tissue sheet** that stretches between the **carotid sheaths** of both sides and is therefore called the **intercarotid lamina**. In the upper and midcervical regions, it is applied to the fascia that directly overlies the **prevertebral muscles**, passing with it behind the pharynx to the opposite side. In the lower cervical region, the lamina is gradually separated from the fascia by intervening fatty tissue and, in the **tracheoesophageal groove** it gains a medially directed attachment on both sides. Below the thyroid gland, it closely follows the course of the common carotid artery and is attached to the trachea down to the dense connective tissue at the base of the heart.

The **thyroid gland** can be enucleated from this bed in its **fibrous capsule** and displaced forward, mainly by blunt dissection, to expose the semitransparent **intercarotid layer** of the **deep cervical fascia** and the **inferior thyroid artery**, which pierces that layer. The vessel arises from the **thyrocervical trunk**, which, like the first part of the inferior thyroid artery, is hidden by the fat pad between the intercarotid and prevertebral fascial layers. The fat pad lies in the area of the **scalenovertebral triangle** and extends downward as far as the subclavian artery and pleural apex.

On the right side the **recurrent laryngeal nerve** winds around the subclavian artery and ascends in the fat pad, passing to the attachment of the intercarotid fascial layer between the trachea and esophagus. It crosses the branches of the **inferior thyroid artery** at about the middle of the right lobe on its medial side, crossing in front of or behind that vessel or passing between its branches, then passes to the larynx near the posterior border of the trachea.

Both **arteries** are accompanied by numerous **veins** that have multiple anastomoses with one another.

The **sternocleidomastoid muscle** and **neurovascular bundle** had to be retracted laterally to demonstrate this region fully.



This dissection gives a detailed view of the location of the two important laryngeal nerves on the right side and their relation to the blood vessels. The **right lobe** of the **thyroid gland** has been elevated from its **bed**, which was described in the previous figure and is unchanged.

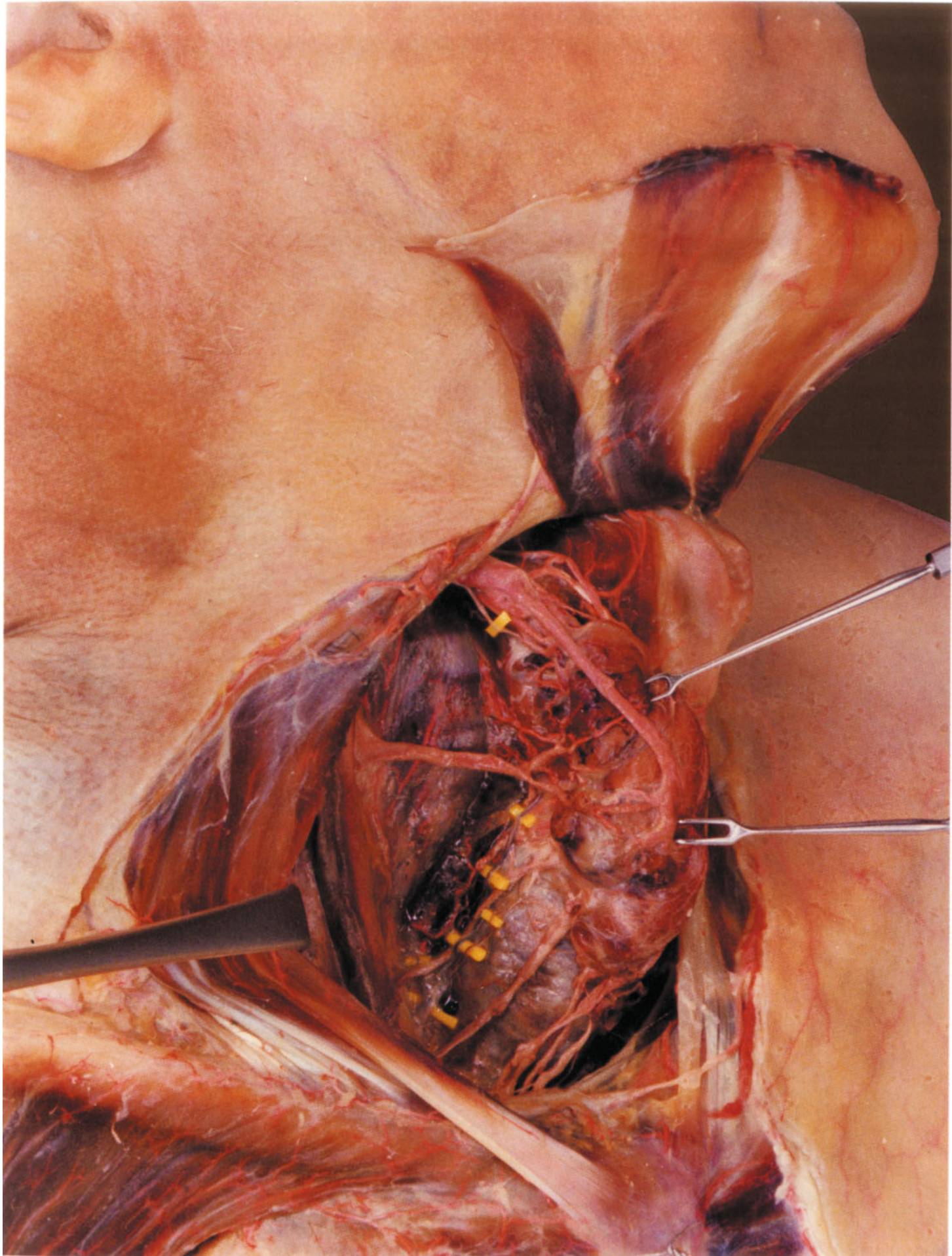
The central portion of the thyroid lobe is securely fixed to the trachea and cricoid on its medial aspect by firm connective tissue known as the **lateral thyroid ligament**. Further displacement of the lobe would require sharp division of this ligamentous attachment.

The **inferior laryngeal nerve**, the terminal branch of the **recurrent laryngeal nerve**, passes behind the lateral thyroid ligament, sometimes piercing it, and enters the larynx medial to the **inferior horn** of the **thyroid cartilage** below the pharyngeal muscles.

The **recurrent laryngeal nerve** has been tagged at several points and is accompanied by a series of **paratracheal lymph nodes** known also as the recurrent chain. The nerve gives off **esophageal** and **tracheal branches** and, on nearing the **trachea**, ascends along its posterior border and crosses the branches of the **inferior thyroid artery**, showing a variable relation to them.

In the area of its glandular branches, near the origin of the **inferior laryngeal artery**, the **inferior thyroid artery** gives off small branches to the pharynx, esophagus, and trachea. The **inferior parathyroid gland** lies upon the fibrous capsule between the glandular branches of the inferior thyroid artery. It displays a size that is somewhat unusual in elderly individuals. The **superior parathyroid gland** is not visible in this figure. In youth the parathyroid glands have a more reddish-yellow color and are approximately lentil-sized.

The **superior thyroid artery** and its large vein are accompanied by the tagged **external branch** of the **superior laryngeal nerve**. Injury to this branch, especially when bilateral, tends to cause hoarseness.

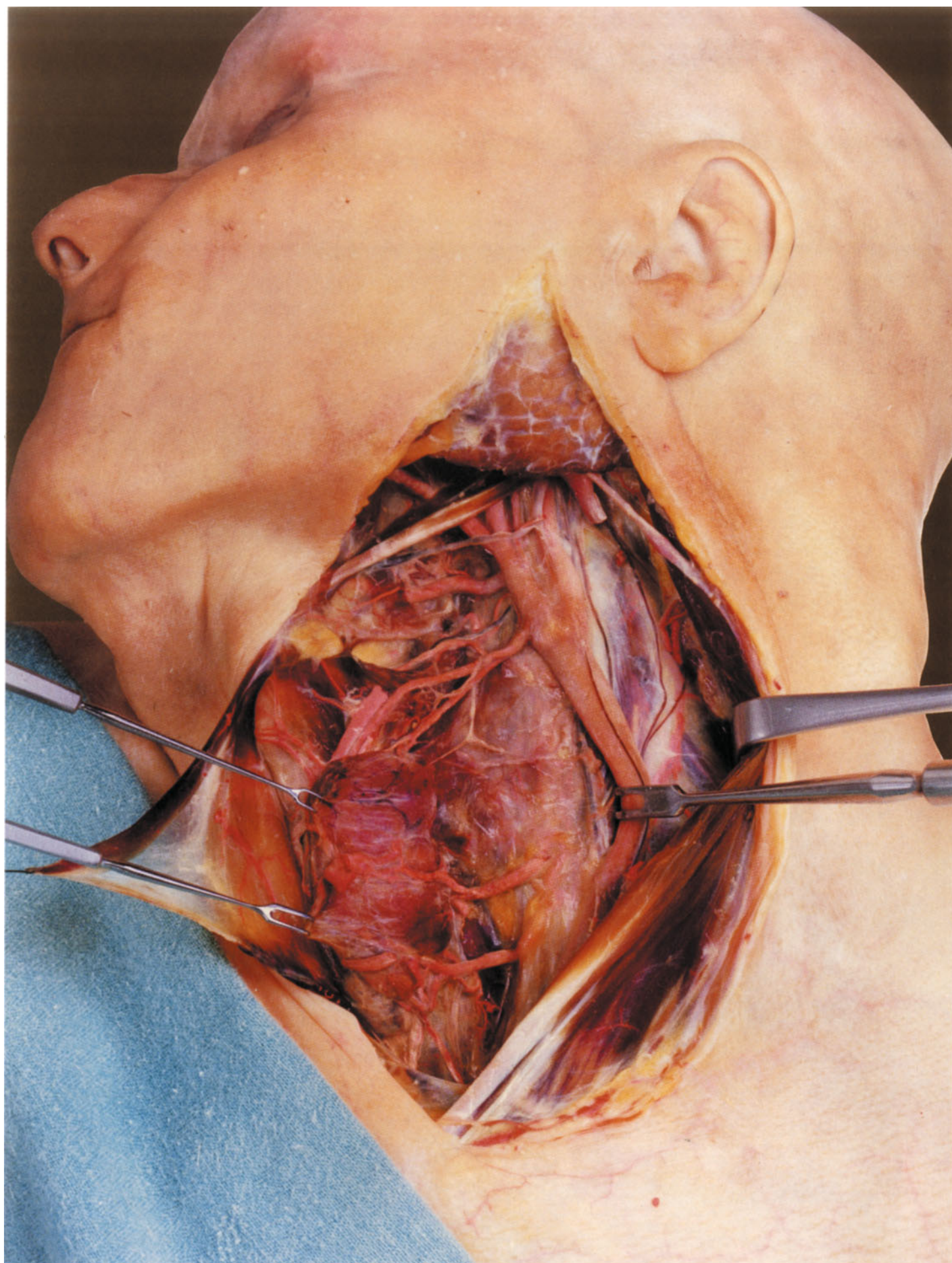


There are two reasons for presenting both left- and right-sided views of the thyroid region: (1) the origin and course of the **recurrent laryngeal nerve** differ on the two sides of the body, and (2) bilateral dissections are helpful in appreciating the structural variability of this region in general.

The distribution of the superior thyroid artery on the left side was shown previously in Figs. 7, 8, 9, 11, and 14, so our exploration of the **left thyroid region** starts with the **left lobe** of the **thyroid gland**, which has been elevated from its bed following division and retraction of the **middle cervical fascia** with its embedded **infrahyoid muscles**. As on the right side, the **bed** is formed by the **intercarotid layer** of the **deep cervical fascia** (see text of Fig. 23), from which two vessels, rather than one, emerge in this specimen. They are the two branches into which the **inferior thyroid artery** consistently divides, though it usually does so closer to the gland.

The **inferior thyroid artery** shows much greater **variability** than the superior thyroid artery. It may be entirely absent on one side or may vary greatly in its caliber. Its point of division is also variable, as this dissection shows. Occasionally, two inferior arteries arise from the **thyrocervical trunk**, or the artery divides only after entering the substance of the gland. As a result, the **recurrent laryngeal nerve** can vary markedly in its relation to this vessel, and this must be considered in the surgery of the thyroid region. The relation of the nerve to the **trachea** is much more constant and therefore is more useful to the surgeon (see Fig. 26).

The **superior parathyroid gland** lies between the divisions of the superior branch, the **inferior parathyroid gland** between the divisions of the inferior branch. The connective tissue capsules of the parathyroid glands are adherent to the outer surface of the **fibrous capsule** of the thyroid gland.



The **recurrent laryngeal nerve** on the left side differs from the right side in that, after winding around the **ligamentum arteriosum** (of BOTALLI) and the **aortic arch**, it runs directly to the **trachea** and ascends along its posterior border. There, as on the right side, it lies within the connective tissue attachment of the **intercarotid layer** of the **deep cervical fascia**.

To demonstrate the **recurrent laryngeal nerve**, the attachment of the **intercarotid layer** has been removed with an adjacent strip down to the bottom of the field. This creates a window that exposes the **esophagus**, its junction with the **pharynx** and, behind it, the **longus colli muscle** covered by the **prevertebral layer** of the **deep cervical fascia**.

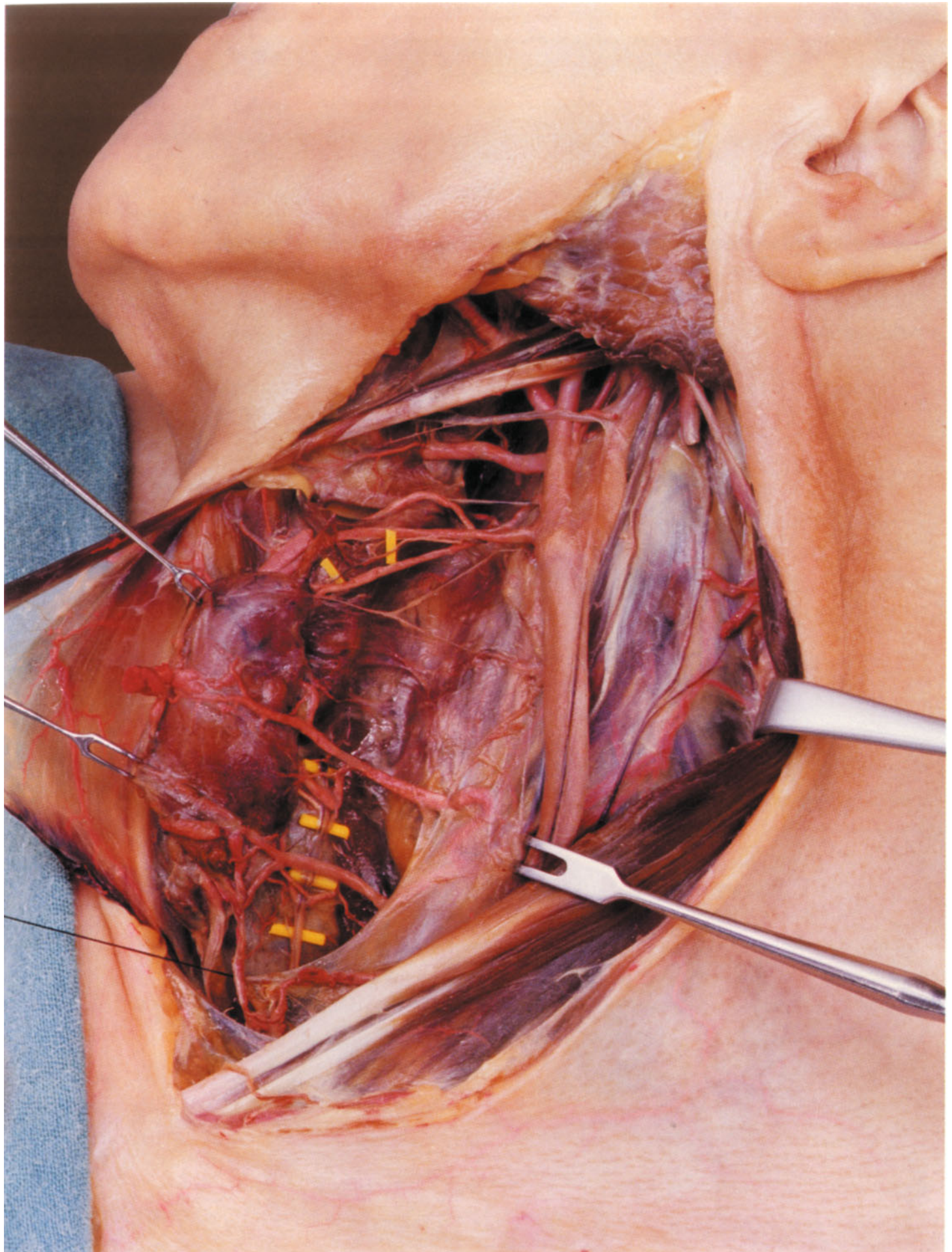
As the two layers of the **deep cervical fascia** diverge above the **pleural apex** in the **scalenovertebral triangle**, the intervening space is occupied by fatty tissue, visible at the lateral edge of the window. Above the window, the **intercarotid layer** passes behind the **pharynx** to the opposite side.

In the present case, the **recurrent laryngeal nerve** crosses behind the branches of the **inferior thyroid artery**. This crossing pattern is variable, so the position of the vessels does not necessarily indicate that of the nerve. However, the **inferior laryngeal nerve** always enters the larynx medial to the palpable inferior horn of the thyroid cartilage.

Splitting of the **recurrent laryngeal nerve** is not uncommon. Often this is merely simulated by an early origin of the **pharyngeal branch**, but it may represent a true splitting of the **inferior laryngeal nerve**.

The **superior thyroid artery** is accompanied by the tagged **external branch** of the **superior laryngeal nerve**.

The thyroid gland is innervated by a rich **autonomic plexus**, whose visible branches in this specimen are derived from the **superior laryngeal nerve** and **sympathetic trunk**.



The **lateral lobes** of the thyroid gland and the **neurovascular bundle** cover the front of a region called the **scalenovertebral triangle**. It is formed by the **scalenus anterior muscle** passing obliquely forward and downward from the **carotid tubercle** of the sixth cervical vertebra and intersecting with the prevertebral **longus colli muscle** to form a triangle that extends down to the **subclavian artery** in its course over the pleural apex.

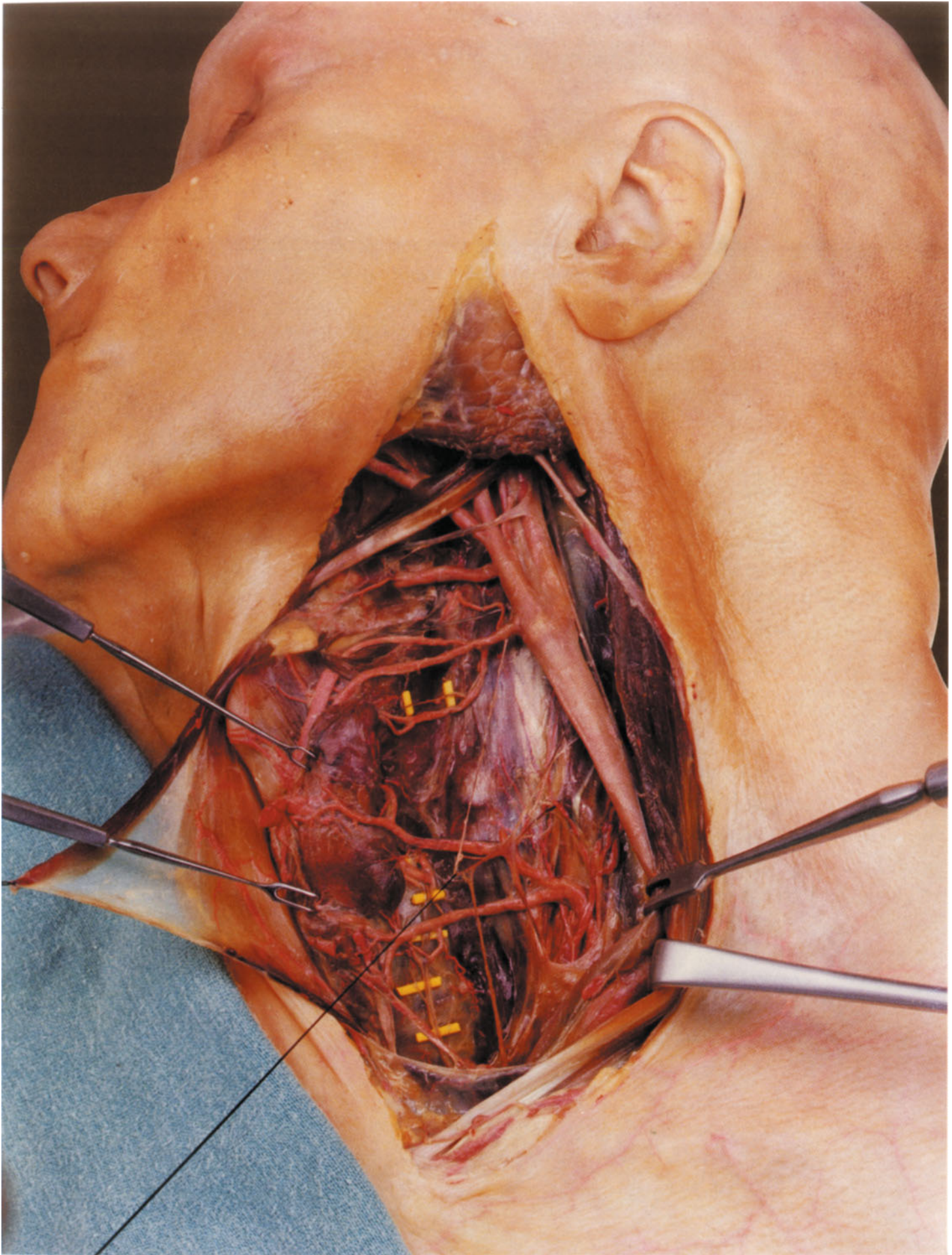
The most important branch of the **subclavian artery** in this region besides the **vertebral artery** is the **thyrocervical trunk**, which gives rise to the **inferior thyroid artery**.

The **scalenovertebral triangle** occupies the area where the **intercarotid layer** and **prevertebral layer** of the **deep cervical fascia** diverge as described in Figs. 23 and 26 and become separated by a **fat pad** that lies above the pleural apex and completely fills the scalenovertebral triangle.

This fat pad contains dense strands of connective tissue that anchor the pleural apex, the strongest of which is the **vertebropleural ligament**.

The **intercarotid layer** of the deep cervical fascia has been removed to display the **vertebropleural ligament**. It arises from the **prevertebral layer** of the deep cervical fascia covering the **longus colli muscle** and from the transverse processes of the lowest two cervical vertebrae. It is attached laterally to the expansions of the **scalenus anterior muscle** and descends with it, passing in front of the subclavian artery to the **pleural apex** where it blends with a firm fascial expansion, the **suprapleural membrane**.

Visible above the curved border of the vertebropleural ligament is the **inferior thyroid artery**. It gives off the **ascending cervical artery**, is crossed by the **sympathetic trunk**, and divides very quickly in this specimen into its two terminal branches. On a deeper plane, a small segment of the **vertebral artery** is seen running toward the apex of the triangle.

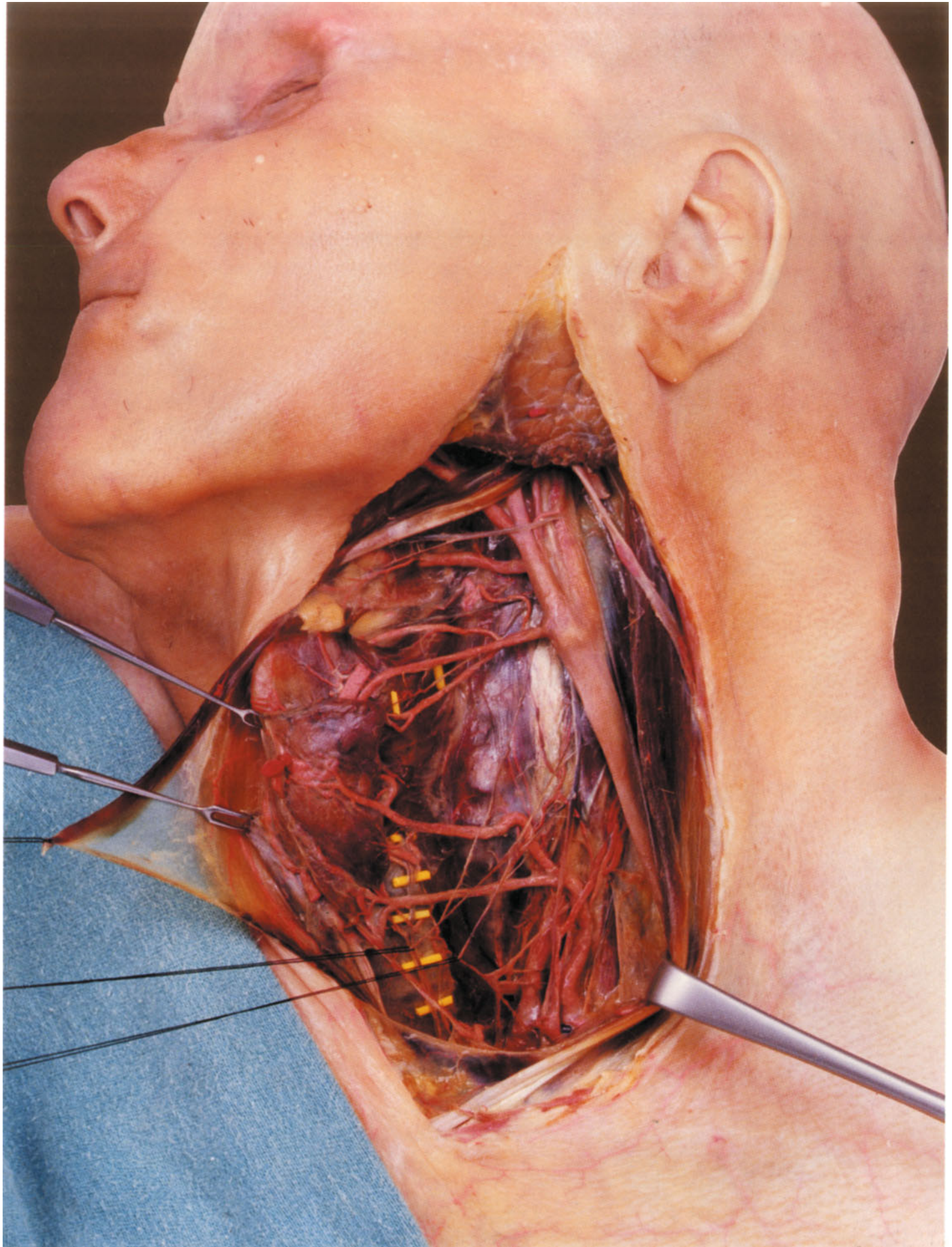


This dissection serves mainly to demonstrate the relationship of the sympathetic trunk to the **inferior thyroid artery**. The **sympathetic trunk** crosses in front of or behind the artery and sometimes forms a loop around it called the **ansa thyroidea**. An inconstant structure in this area is the **middle cervical ganglion**. A **middle cervical cardiac nerve** descends from this ganglion and unites with a **superior cervical cardiac branch** from the superior laryngeal nerve to form a thick **cardiac nerve**, which enters the **superficial cardiac plexus** in front of the aortic arch. The same ganglion sends a thin **communicating branch** to the cervical plexus.

With the **vertebropleural ligament** removed, we can trace the course of the **sympathetic trunk**. It passes to the inferior cervical ganglion, which usually is fused with the first thoracic ganglion to form the **cervicothoracic ganglion**. The ganglion in front of the vertebral artery, called the **vertebral ganglion**, gives off the **inferior cardiac nerve** and the **ansa subclavia**, which loops around the subclavian artery. Several **communicating branches** from the ganglion pass behind scalenus anterior muscle to the brachial plexus.

The **subclavian artery** is visible in this lower portion of the scalenovertbral triangle. It gives rise to the **thyrocervical trunk** and the **vertebral artery**, which is accompanied laterally by the **vertebral vein** as it receives more superficial veins that have united to form a trunk. In the depths of the scalenovertbral triangle, medial to the vertebral artery, lies the **deep cervical artery**, whose parent vessel, the **costocervical trunk** of the subclavian artery, is not visible in this dissection. The inferior pole of the lateral lobe of the thyroid gland normally lies near the subclavian artery and, when slightly enlarged, may extend to the **pleural apex**.

The mobilized **left lobe** of the **thyroid gland** is fixed by the **lateral thyroid ligament**, whose position is marked by the light area in the upper part of the trachea.



The **thoracic duct** crosses the **scalenovertebral triangle** behind the **sternocleidomastoid muscle**, traversing the fat-filled connective tissue space above the pleural apex formed by the two diverging layers of the **deep cervical fascia**. It crosses anterior to the **vertebropleural ligament** and passes in front of the **scalenus anterior muscle** to the junction of the **left subclavian** and **internal jugular veins**.

The lateral extension of the **middle cervical fascia** descends from the **omohyoid muscle** to the posterior surface of the **clavicle**. Its lateral portion has been resected to expose the area behind it, including the slight inferior bulge caused by the **subclavian artery**. The artery itself is not seen, as it is covered by extensions of the **vertebropleural ligament**. The ligament also obscures the **thyrocervical trunk** and the origin of the **transverse cervical artery**.

Above the omohyoid muscle, the **scalenus anterior** and **medius muscles** and the **brachial plexus** are covered by the **prevertebral layer** of the **deep cervical fascia**. The anterior or **intercarotid layer** has been elevated with the neurovascular bundle and the sternocleidomastoid muscle and retracted medially. The **thoracic duct** is applied to its anterior wall and consequently is often difficult to locate.

On entering the neck, the **thoracic duct** quickly leaves the left side of the **esophagus**, passing behind the **common carotid artery** and then the **internal jugular vein** before descending in front of the subclavian artery. In the area where the common carotid artery separates from the internal jugular vein, the **intercarotid layer** of the **deep cervical fascia** is supplemented laterally by a connective tissue expansion from the **carotid sheath** to the adventitia of the **internal jugular vein**. It reaches inferiorly to the **brachiocephalic vein**.

Starting from the **connective tissue space** above the **pleural apex** formed by the divergence of the two **layers** of the **deep cervical fascia** and their lateral **expansion** from the carotid sheath, we can dissect medially to the **esophagus** and to the **posterior mediastinum** in front of the vertebral column. This very large fat-filled space, which extends as far as the diaphragm, was called the “danger space” by GRODINSKY and HOLYOKE because of its role in the spread of infections. It is the space that is traversed by the **thoracic duct**.

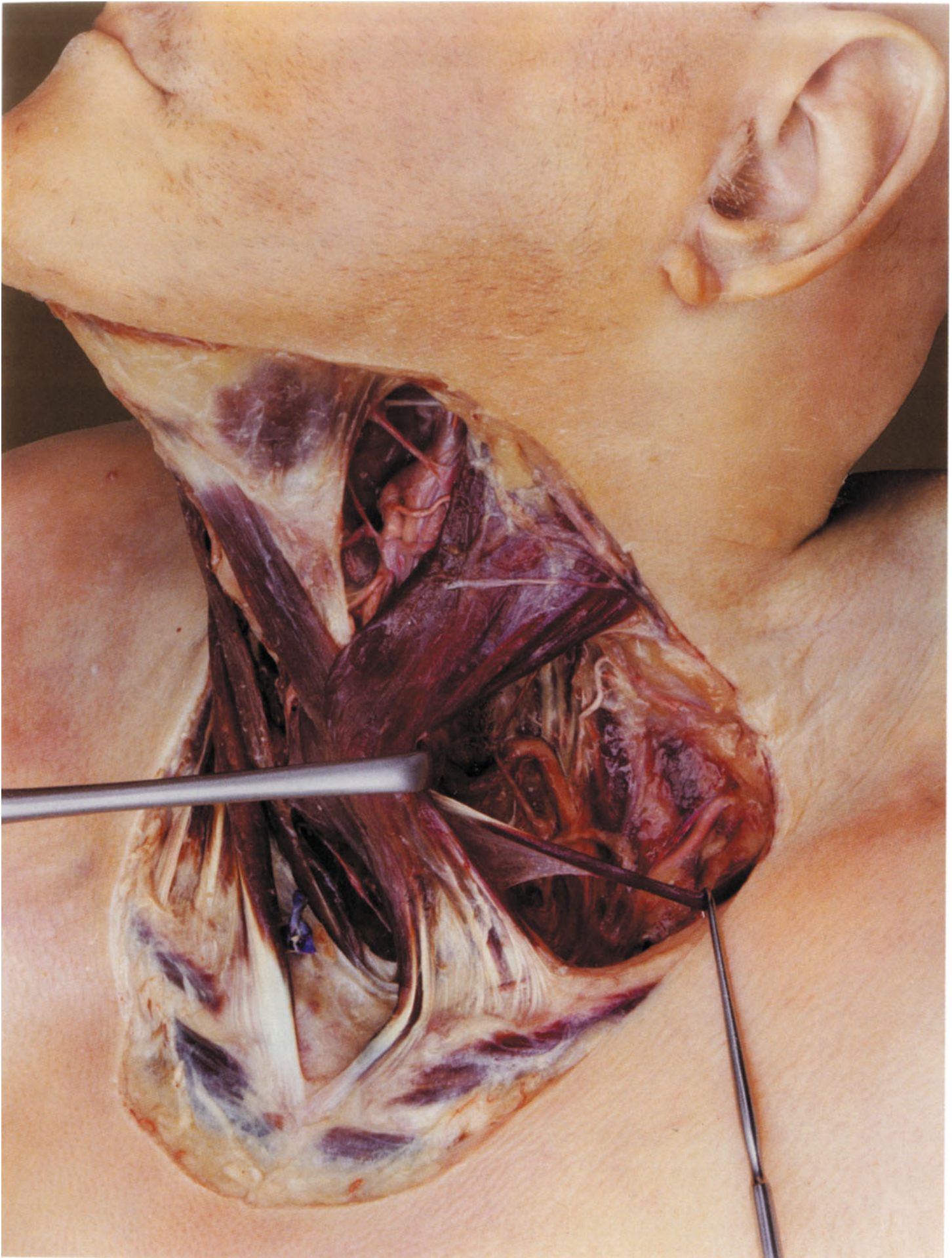


Figure 30

**Lateral Cervical Region 1
(Right Side)**

This region is bounded by the **sternocleidomastoid muscle**, the **trapezius muscle**, and the **clavicle**. The inferior belly of the omohyoid muscle defines an **omoclavicular triangle** located in the area where the **greater supraclavicular fossa** forms a skin depression in non-obese individuals.

The entire region is covered by a **superficial cervical fascia** that splits at the borders of the foregoing muscles. The superficial layer has been removed to expose the underlying **muscles** and an intervening **fat pad** that contains numerous **lateral cervical lymph nodes**, blood vessels, the **accessory nerve**, and branches of the **cervical plexus**.

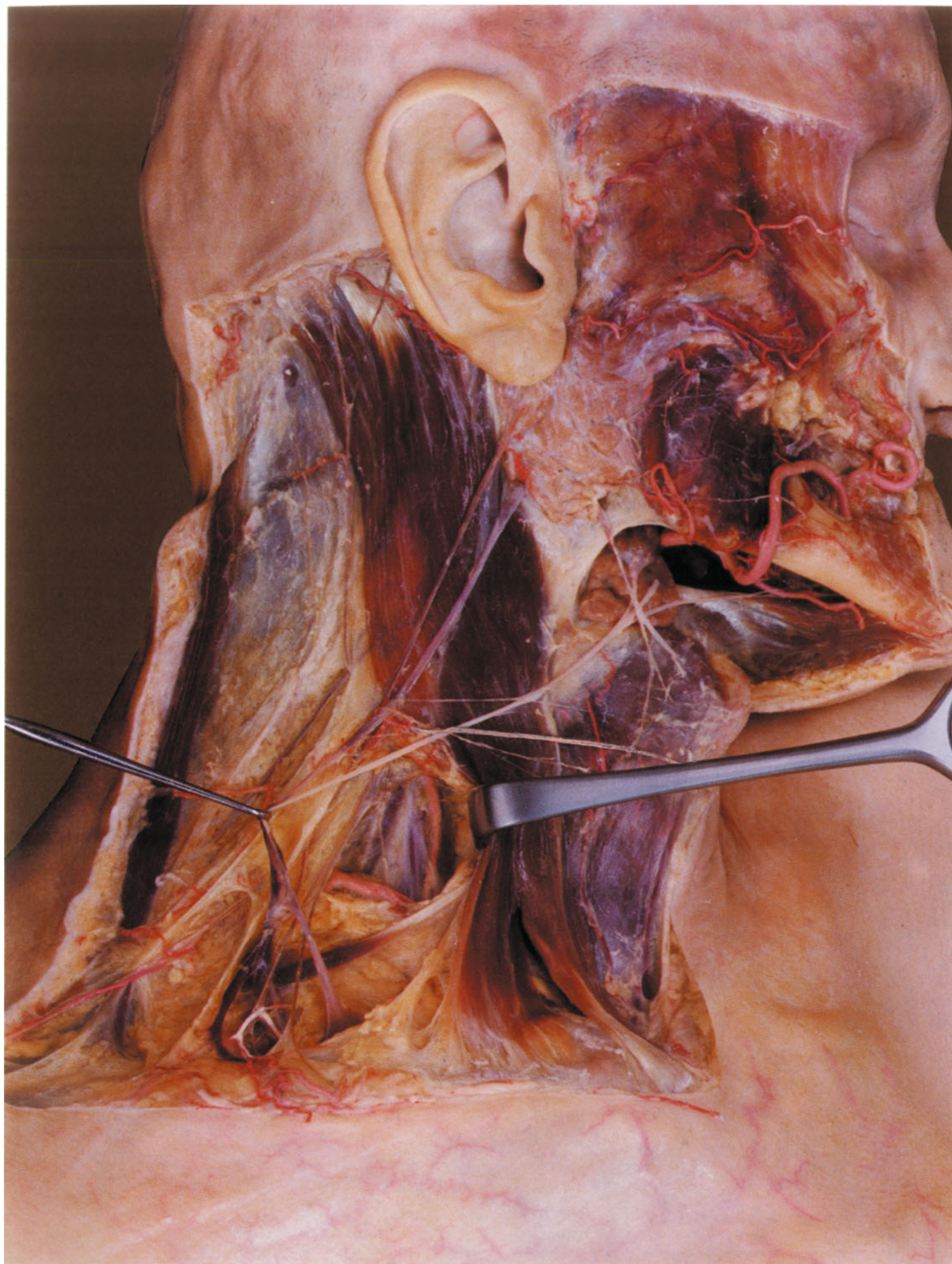
The **accessory nerve**, exposed by incision of the superficial cervical fascia, occupies a relatively superficial plane within the fat pad. It passes beneath the **trapezius muscle** just above the clavicle.

The superficial cervical fascia has been windowed above the **clavicle** to demonstrate the inferior belly of the **omohyoid muscle**. The lateral part of the **middle cervical fascia** descends from that muscle to the posterior surface of the clavicle. There it combines with the superficial cervical fascia to form a pouch that contains some fat and the drainage from the **external jugular vein**, behind which lies the bulk of the fatty tissue in this region.

The fat in the upper part of the fascial window has been cleared to the plane of the **deep cervical fascia**, through which the **scalenus anterior** and **medius muscle**, the **brachial plexus**, and the **phrenic nerve** can be seen. The **transverse cervical artery** is crossed by the **supraclavicular nerves**.

The remaining **cutaneous nerves** of the cervical plexus surface at the posterior border of the **sternocleidomastoid muscle**. The **great auricular nerve** has split prematurely into two branches, which appear as separate nerves.

The **facial vein** enters the **external jugular vein** (retracted posteriorly with a hook) at an exceptionally low level in this specimen.



Behind the transverse processes of the **vertebrae**, a dense aggregation of muscles called the **transversospinal muscles** creates a “**musculovertebral block**”, from which the **levator scapulae muscle** can be separated and defined as a distinct layer.

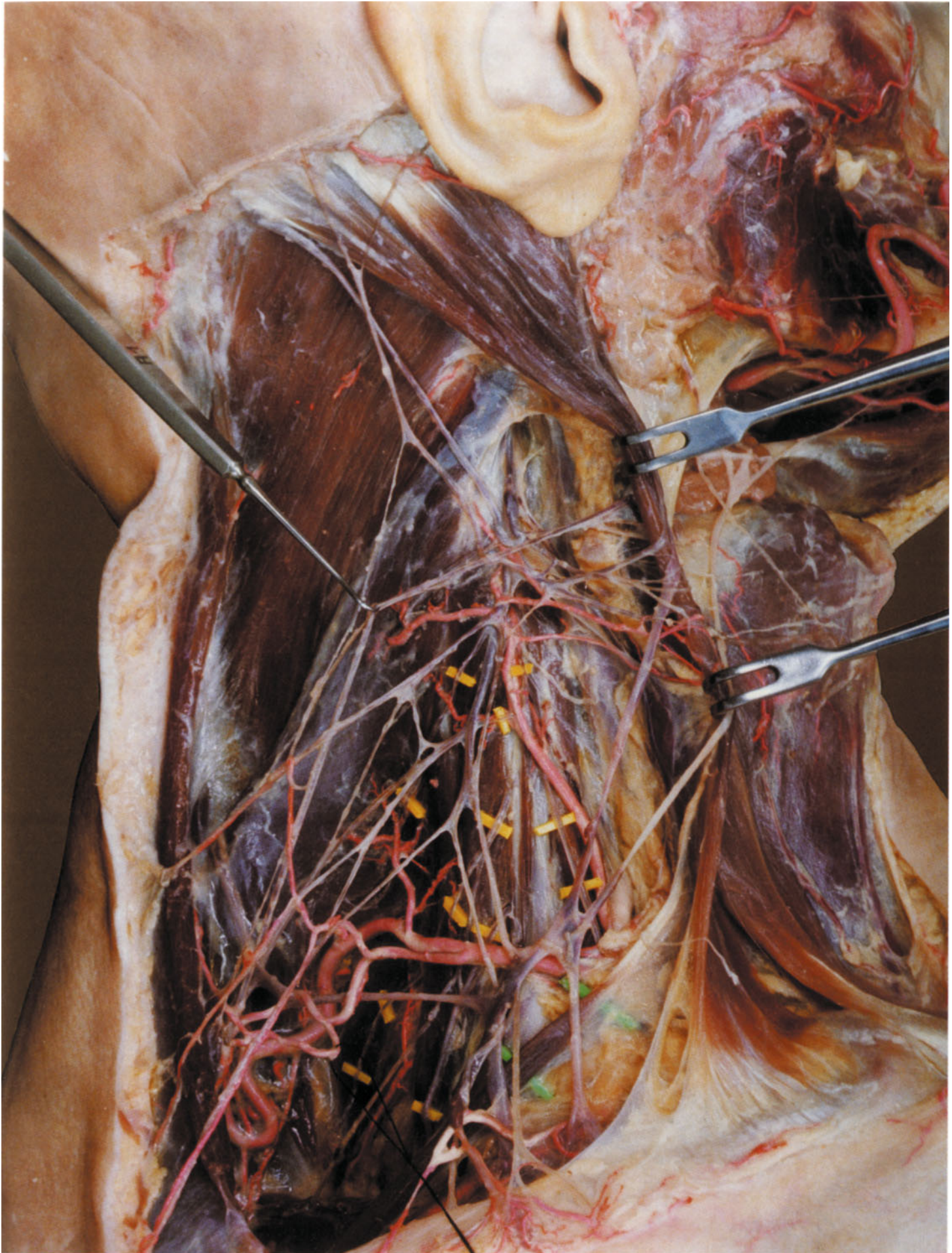
The musculovertebral block is supplemented anteriorly by the **scalene muscles**, which form a bridge to the **thoracic wall**. The **deep cervical fascia** overlying the muscles has been removed.

The **brachial plexus** emerges in the posterior interval between the **scalenus anterior** and **scalenus medius muscle**. Above the third cervical vertebra, the **longus capitis muscle** continues the scalene interval anteriorly. Just above this vertebra the **anterior ramus** of the **third cervical nerve**, the largest component of the **cervical plexus**, splits into multiple branches with which the **accessory nerve** is also connected. These branches give rise to numerous motor and sensory nerves.

As with all the nerves of the cervical plexus, the **fourth cervical nerve** is united with the **third cervical nerve** by a communicating loop or **ansa**. The **supraclavicular nerves** and a **trapezian branch** arise from the fourth cervical nerve. The **phrenic nerve** continues from the tagged connection between C4 and C5, still covered on the **scalenus anterior muscle** by the deep layer of the **deep cervical fascia**.

The **long thoracic nerve** in this specimen pierces the **scalenus medius muscle** exceptionally close to its anterior border and gives off two branches. The tagged thin branch is a motor branch to **scalenus medius muscle**, and the thicker branch is distributed to the highest slip of **serratus anterior**. The **dorsal scapular nerve** runs over the surface of **scalenus posterior** behind the **scalenus medius muscle**.

The **sternocleidomastoid muscle** has been pulled forward to show the sites of emergence of the cervical nerves, also demonstrating the site where the **accessory nerve** (elevated on a small hook) pierces the sternocleidomastoid muscle.



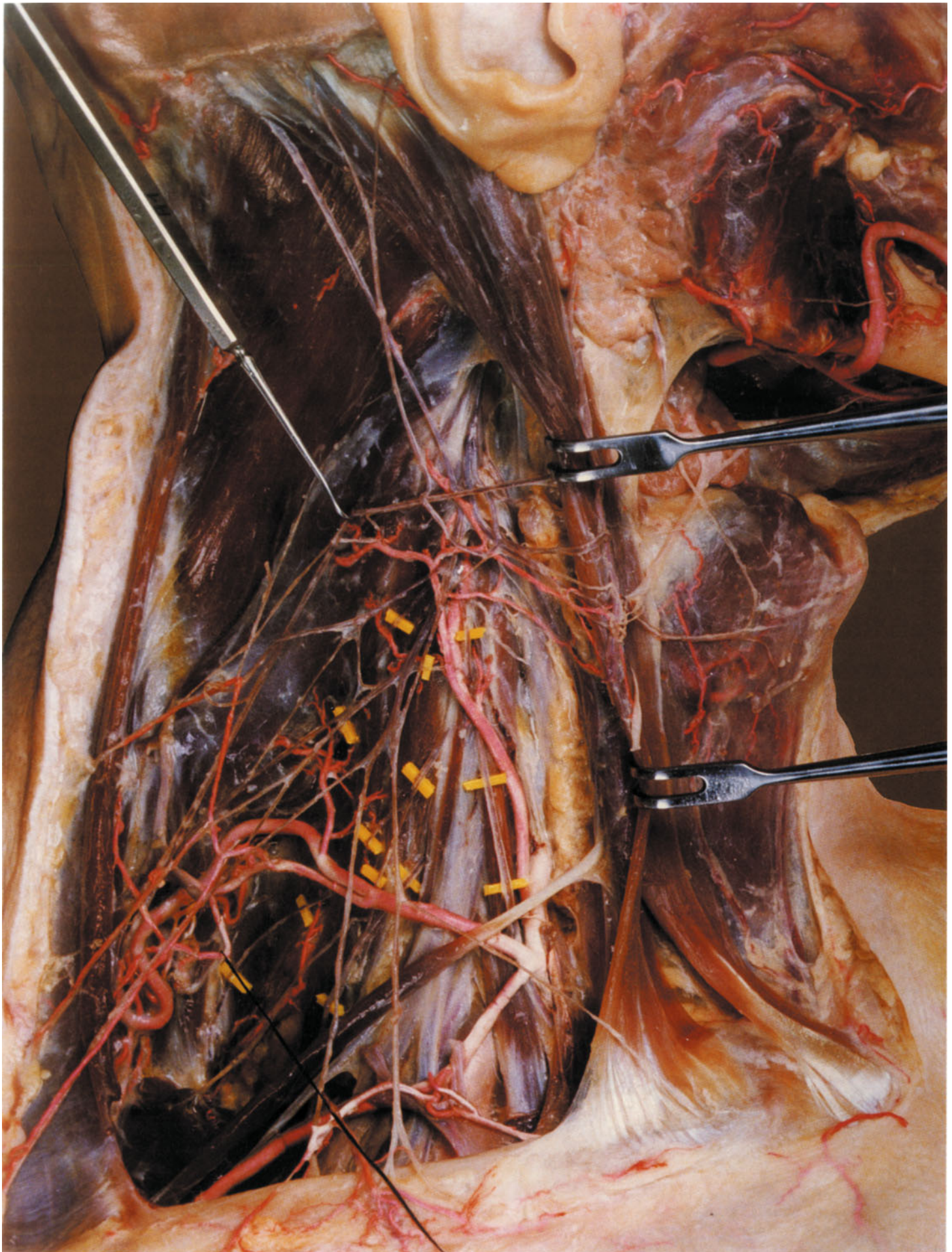
A deep incision between the **scapular muscle layer** and the **musculovertebral block** demonstrates the **arterial anatomy** of this region better. The incision extends upward to the fourth cervical vertebra, where the **levator scapulae muscle** has its most caudal origin and blends inferiorly with the thin, mobile tissue plane between the **thorax** and **scapula**. Following this plane is the **dorsal scapular nerve**, which relates anteriorly to the **rhomboid muscles**. Closer to the **medial scapular border** in the same plane lies the terminal segment of the **deep branch** of the **transverse cervical artery**.

The **transverse cervical artery** arises from the **thyrocervical trunk**. It enters the lateral cervical region in front of the **scalenus anterior muscle** and divides into two branches. The **superficial branch** gains the plane of the **accessory nerve** between the **trapezius** and **levator scapulae muscles** and runs close to the nerve. The **deep branch** gains the same plane initially but then curves round the scapular attachment of **levator scapulae**, passing in front of the **rhomboid muscles** and entering the plane of the **dorsal scapular nerve**. The vessel sometimes pierces the **levator scapulae muscle** on this path.

It is very common for the **deep branch** to arise separately from the **subclavian artery** and course through the **brachial plexus**. It has recently been termed the **dorsal scapular artery** by analogy with the dorsal scapular nerve.

The **suprascapular artery** also arises from the **thyrocervical trunk** in most cases. It is related to the **suprascapular nerve** from the **brachial plexus**. The lateral part of the **middle cervical fascia** had to be removed to expose the artery, which lies in the **omoclavicular triangle** near the clavicle.

The **ascending cervical artery** arises from the **inferior thyroid artery** and ascends medial to the **phrenic nerve**. Along the cervical nerves it distributes **spinal branches** to the spinal cord that anastomose with the **vertebral artery**. At or before the level of the third cervical vertebra, it splits into several **muscular branches** that supply the adjacent muscles along with the deep posterior neck muscles.



The **submandibular triangle** is bounded by the **digastric muscle** and the **mandible**. It is related to the superficial cervical region because the **submandibular gland** lies in a compartment of the **superficial cervical fascia**.

The **compartment** of the **submandibular gland** has been opened from the surface. Its medial wall relates to the **mylohyoid muscle** and the deeper fibrofatty layer. It is so delicate and transparent that it is not grossly visible.

Between the **submandibular** and **parotid compartments** is a thickened, fibrous band of **superficial cervical fascia** that is termed the **angular tract** because of its attachment to the **mandibular angle**.

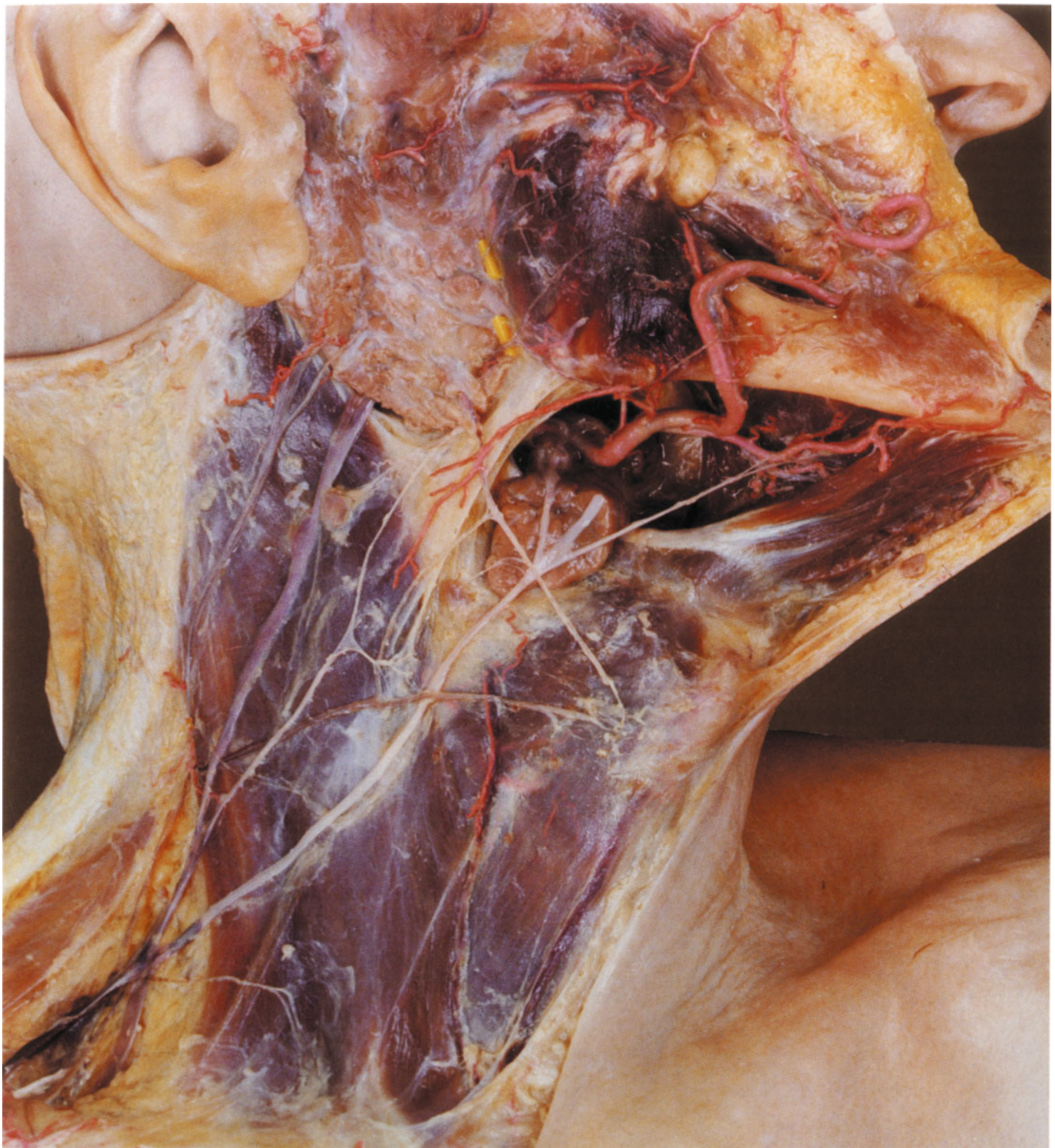
Most of the submandibular compartment is occupied by the **submandibular gland**, which, when fully unfolded, sweeps around the posterior border of the **mylohyoid muscle**. The large **facial artery** traverses the medial portion of the compartment, giving off the **submental artery** and a cutaneous artery.

Superficial to the submandibular gland, the resected **facial vein** has passed through the compartment and enters an opened **flat tunnel** superficial to the **superficial cervical fascia**, which has been left intact over the remainder of the neck. The vein runs unusually far downward in this tunnel before uniting with the external jugular vein.

The **external jugular vein** arises from the **retromandibular vein** and crosses the **sternocleidomastoid muscle**, also in a flat tunnel, whose roof attachment is more easily seen. Anterior to it, the branches of the **transverse cervical nerve** unite with the **cervical branch** of the **facial nerve** to form the **superficial ansa cervicalis**.

Behind the external jugular vein, the anterior branch of the **great auricular nerve** passes upward and enters the **parotid gland** in the usual fashion. The cutaneous artery accompanying it arises from the **posterior auricular artery**.

The **cutaneous artery** from the **carotid triangle** region is derived from the **sternocleidomastoid branch** of the **superior thyroid artery**.



In this dissection the structures of the fibrofatty layer lateral to the **hyoglossus muscle** have been dissected free.

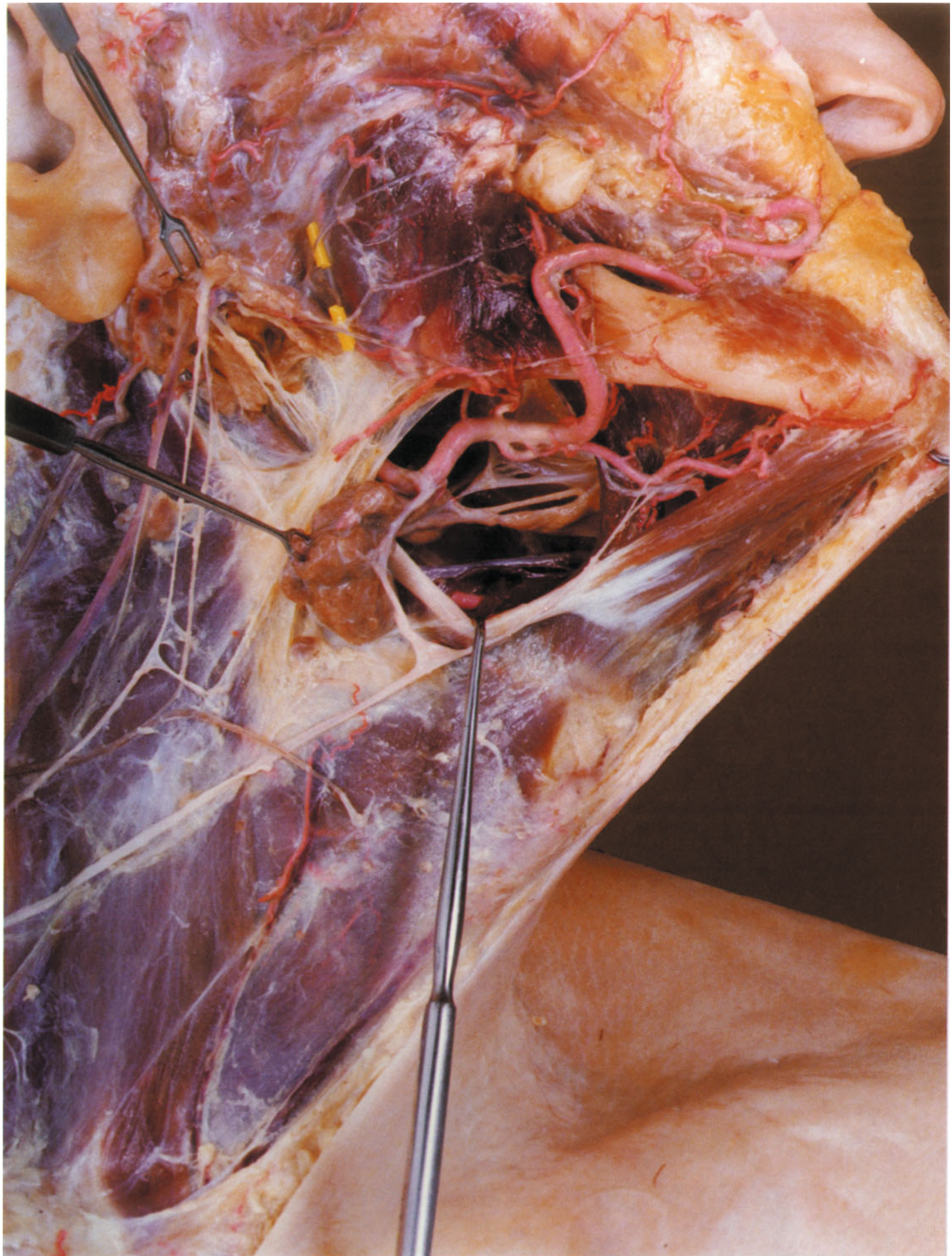
The **submandibular duct** (of WHARTON) emerges from the retracted **submandibular gland** and passes forward into the interval between the **mylohyoid** and **hyoglossus muscles**. There it lies medial to the **sublingual gland**, whose posterior end has been drawn a short distance out of the intermuscular interval. When normally positioned, the **submandibular gland** hooks around the posterior border of the **mylohyoid muscle** and closely approaches the **sublingual gland**.

The **hypoglossal nerve** enters the same interval after crossing under the intermediate tendon of the **digastric muscle**. The hypoglossal nerve, intermediate tendon, and posterior border of the **hyoglossus muscle** form the **lingual triangle**, in which the muscle is divided to expose the **lingual artery**. This triangle has been expanded somewhat by downward traction on the intermediate tendon.

The **lingual nerve** enters the upper part of this interval and passes laterally to medially below the **submandibular duct**. The **submandibular ganglion** occurs at the deeper, arched portion of the nerve and is connected to it by pre- and postganglionic fibers. **Postganglionic fibers** from the ganglion innervate the **submandibular gland**.

Visible on the outer surface of the **mylohyoid muscle** are the **submental artery** and the **mylohyoid nerve**, which arises from the inferior alveolar nerve and has crossed the inner surface of the mandible.

Behind the **angular tract** of the **superficial cervical fascia**, the **parotid gland** has been elevated from its compartment to demonstrate the emerging **facial nerve branches** and the **superficial ansa cervicalis**, which is duplicated in this specimen.



The **parotid gland** is covered by a thick, feltlike **parotid fascia**, which tends to split into layers in well-nourished individuals. The fascia thins toward its anterior border, and the glandular parenchyma is visible through it. This fascia blends anteriorly with the thin **masseteric fascia**, which attaches to the delicate sheath of the **buccal fat pad** but is not continued into the buccal region. As a result, the fatty tissue on the **buccinator muscle** is in direct continuity with the rest of the **subcutaneous fat**.

The **parotid fascia** is part of the **deep layer of the stratum subcutaneum**. It combines with the **masseteric fascia** to form a closed layer that also covers the **accessory parotid gland**, the **parotid duct**, and the emerging branches of the **facial nerve**.

The **platysma** and the **muscles of facial expression** have a common genetic origin and display corresponding relationships. Among the muscles of facial expression exposed in this dissection are the **orbicularis oculi** and **zygomaticus major muscles**. The **risorius** and **depressor anguli oris muscles** have been dissected free separately through the buccal fat. In the angle formed by the two muscles, **superficial bundles** of the **platysma** radiate into these muscles and into the skin of the oral commissure and lower lip. The **deep bundles** of the platysma are attached to the inferior border of the **mandible**.

It is not unusual to find **short muscle bundles** at the border of the platysma. The upper short muscle bundle is attached between the **parotid fascia** and the **risorius muscle**. Above this bundle, a portion of the **parotid gland** is visible through the thin fascia posteriorly, and the **masseter muscle** is visible anteriorly. The **buccal fat pad** overlaps the anterior border of the masseter muscle, and the **accessory parotid gland** is visible above it.

The thick portion of the **parotid fascia** has been incised to expose the **auricularis magnus nerve** and its branches.



The **parotid fascia** and **masseteric fascia** have been removed, and the facial nerve branches emerging from the **parotid gland** have been isolated and tagged. The **facial nerve branches** are highly variable in their number and their pattern of interanastomosis, so they are best named and described in terms of the areas that they supply.

The branches that supply the facial muscles above the palpebral aperture are called the **temporal branches**. True to their name, they pass over the temporal region and innervate the **anterior** and **superior auricularis muscles**, the anterior muscles of the **scalp**, and the upper portion of **orbicularis oculi**.

The tagged nerve that enters the temporal region posteriorly with the **superficial temporal artery** is the **auriculotemporal nerve**. It is derived from the **mandibular branch** of the **trigeminal nerve** and has only one important anastomosis with the facial nerve.

The **parotid duct** is usually accompanied by several large nerve filaments called the **zygomatic branches**. They supply the lower part of **orbicularis oculi** and the **muscles of facial expression** between the palpebral and oral fissures.

Varying numbers of relatively thin **buccal branches** of the facial nerve pass over the **masseter muscle** and disappear beneath the remnant of the **platysma**. Below them are the **marginal mandibular branch** and the **cervical branch**, which are described more fully in the next figure with the platysma removed.

The **platysma** also covers the **facial artery** and **vein** and the further course of the **retromandibular vein**, which has emerged from the lower pole of the parotid gland.

The **buccal fat pad** has been elevated somewhat from the anterior border of the **masseter muscle**. The tagged **parotid duct** crosses over the fat pad and passes deeply to the **buccinator muscle**.



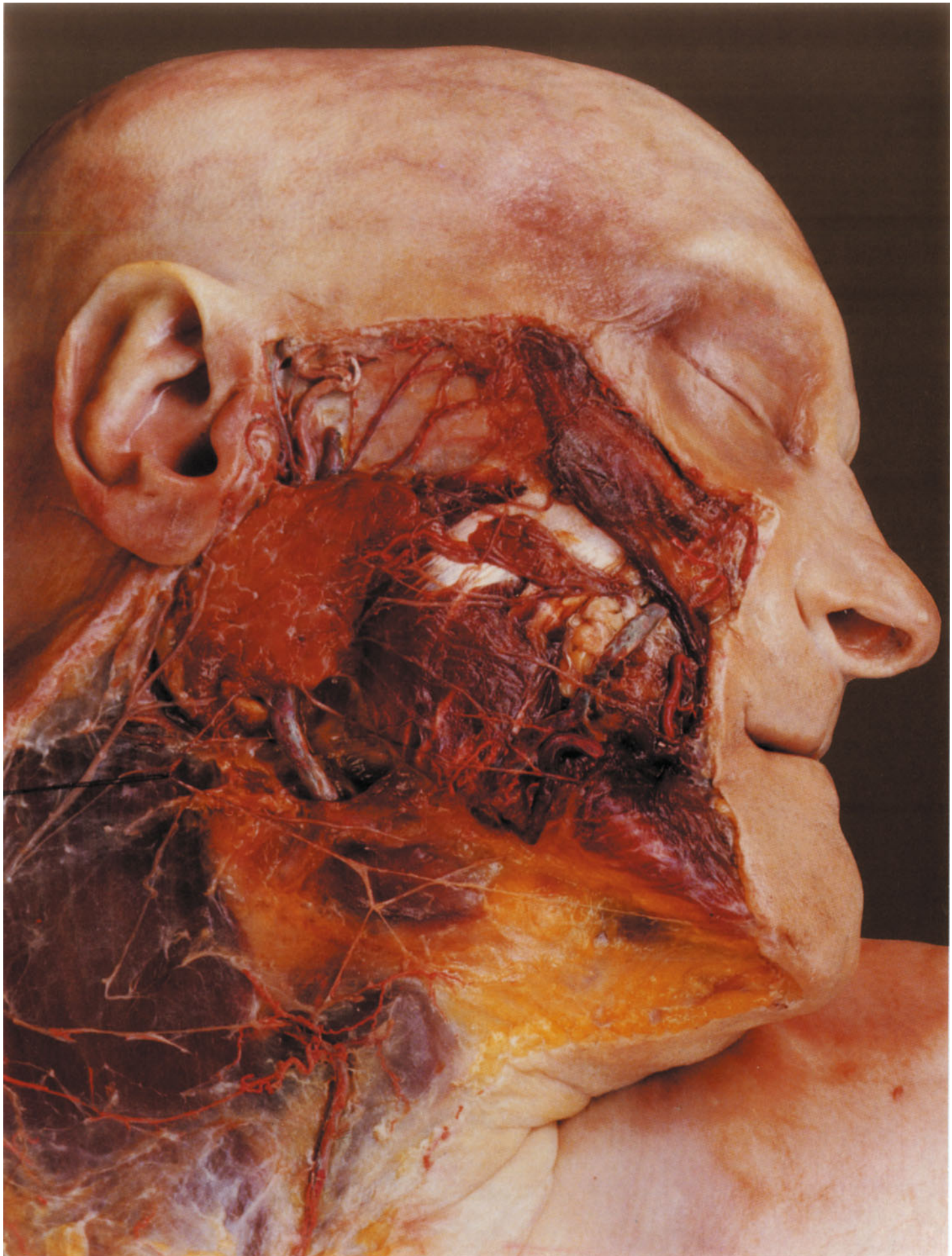
The platysma has been completely removed to demonstrate the full length of the two **lowest branches** of the **facial nerve**. They branch from the **lower main division** of the facial nerve that arises within the substance of the parotid gland.

The **marginal mandibular branch** runs near the inferior mandibular border to supply the muscles of facial expression below the oral fissure. It may consist of two branches or, as here, may anastomose with a **buccal branch**. If the marginal mandibular branch is late in separating from the **cervical branch** of the facial nerve, its course is shifted downward and it may be found at some distance from the **mandibular angle**. Its main branch crosses superficial to the **facial artery and vein**.

The **cervical branch** of the facial nerve, marked here with a traction thread, supplies the **platysma**. The distributions of the facial nerve branches may overlap. It is common for the **marginal mandibular branch** to distribute short branches to the upper part of the platysma, and the **anterior branch** of the cervical division apparently contributes through its terminal and side branches to the innervation of the muscles of facial expression.

This anterior branch runs in a thin **fatty layer** on the **deep surface** of **platysma** above the hyoid. The fatty layer extends from the carotid triangle to the chin, sparing the area about the **submandibular gland**. A thicker layer of fat on the **outer surface** of **platysma** in the same region is responsible for the **double chin** that develops in obese individuals.

The peripheral branches of the **facial nerve** undergo numerous **anastomoses** with all adjacent **sensory nerves**, and similar connections may occur within the parotid gland. The branch of the **great auricular nerve** seen entering the parotid forms a particularly large anastomosis with the **intraparotid plexus**.



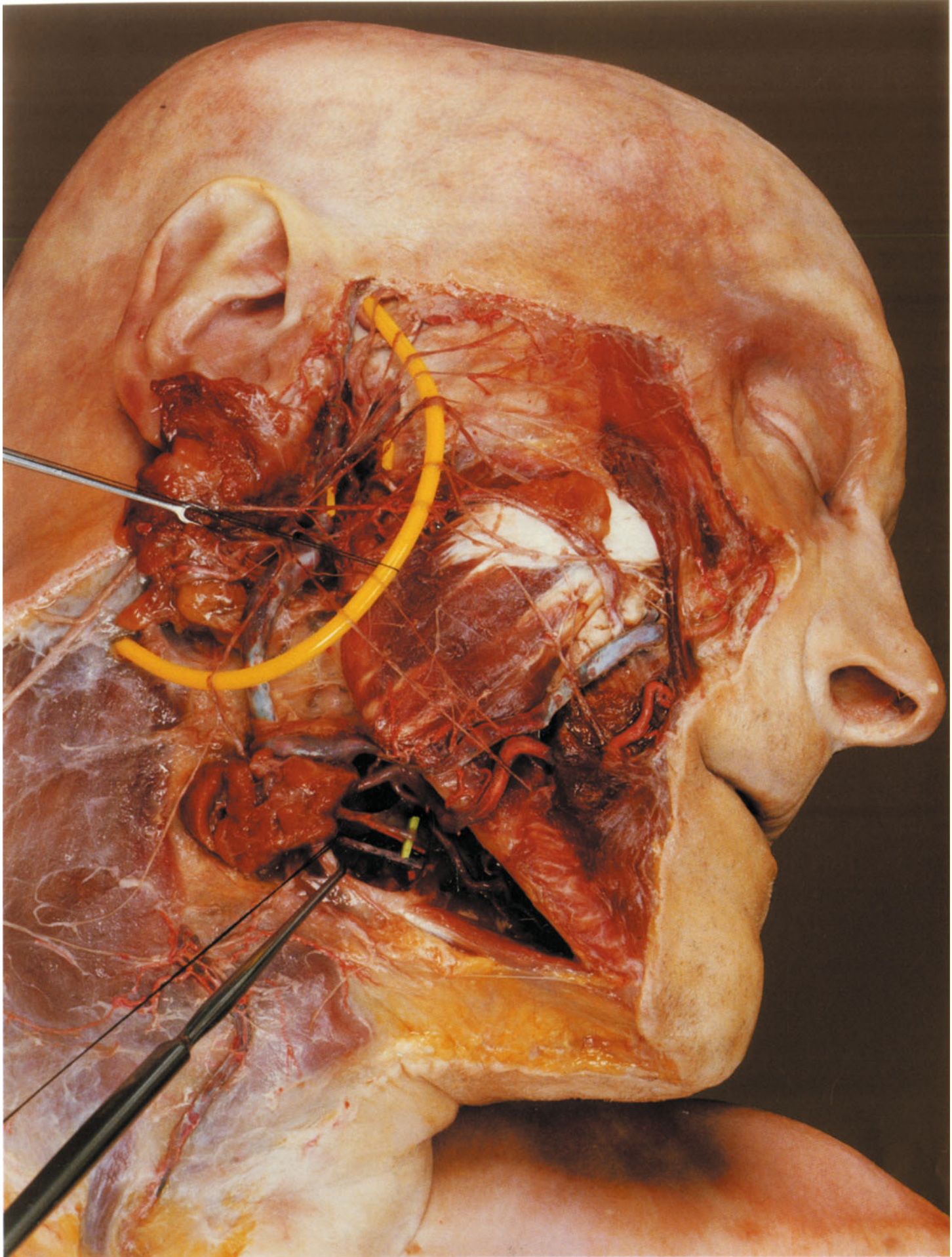
The **parotid gland** has been divided into a **superficial part** and a **deep part** on the plane of the **parotid plexus** and the emerging **facial nerve branches**. The two parts are separated from each other by an incomplete connective tissue layer of the parotid plexus, but they are interconnected through large gaps in the plexus and through their system of excretory ducts.

The **parotid plexus** includes a superior and an inferior branch. The **superior branch** gives origin to the temporal and zygomatic branches, so it is also known as the **temporofacial branch**. The **inferior branch** is known alternately as the **cervicofacial branch** because it gives rise to the marginal mandibular branch and cervical branch. The **buccal branches** may be associated with the superior or inferior branch.

Behind the temporomandibular joint, the **auriculotemporal nerve** curves upward into the temporal region after first giving off the tagged **communicating branches** to the **facial nerve**, which supply the parotid gland with **secretory fibers**. One such fiber bundle is seen passing to the superficial part of the gland as a prolongation of the lower communicating branch. Below it, a branch of the **great auricular nerve** is seen to connect with the **parotid plexus**.

Bisection of the parotid gland has exposed the deep portion of the **retromandibular fossa**, which contains the **retromandibular vein** and the **external carotid artery** with its terminal divisions. The **transverse facial artery** shows an early origin from the **superficial temporal artery** and, in this specimen, is distributed chiefly to the **masseter muscle** and **parotid gland**. Above it, the **middle temporal artery** springs from the superficial temporal artery and, in company with the **middle temporal vein**, pierces both layers of the **temporal fascia** to supply the **temporalis muscle**.

The **retromandibular vein**, which originally traversed the substance of the gland, unites with the **facial vein** and drains exclusively into the **internal jugular vein** in this case without forming an **external jugular vein**.



The division of the parotid gland into a **superficial part** and **deep part** is highly variable. The deep part is the larger in this specimen, as it is in 50 % of the population according to HURFORD.

The **vascular supply** of the gland includes a very well-developed **transverse facial artery** and **zygomatico-orbital artery** and a poorly developed **retromandibular vein**. Given the connections of the **pterygoid plexus** with the **pharyngeal veins**, most of the venous return from this region can drain into the **internal jugular vein** through a **pharyngeal vein** rather than the **maxillary veins**.

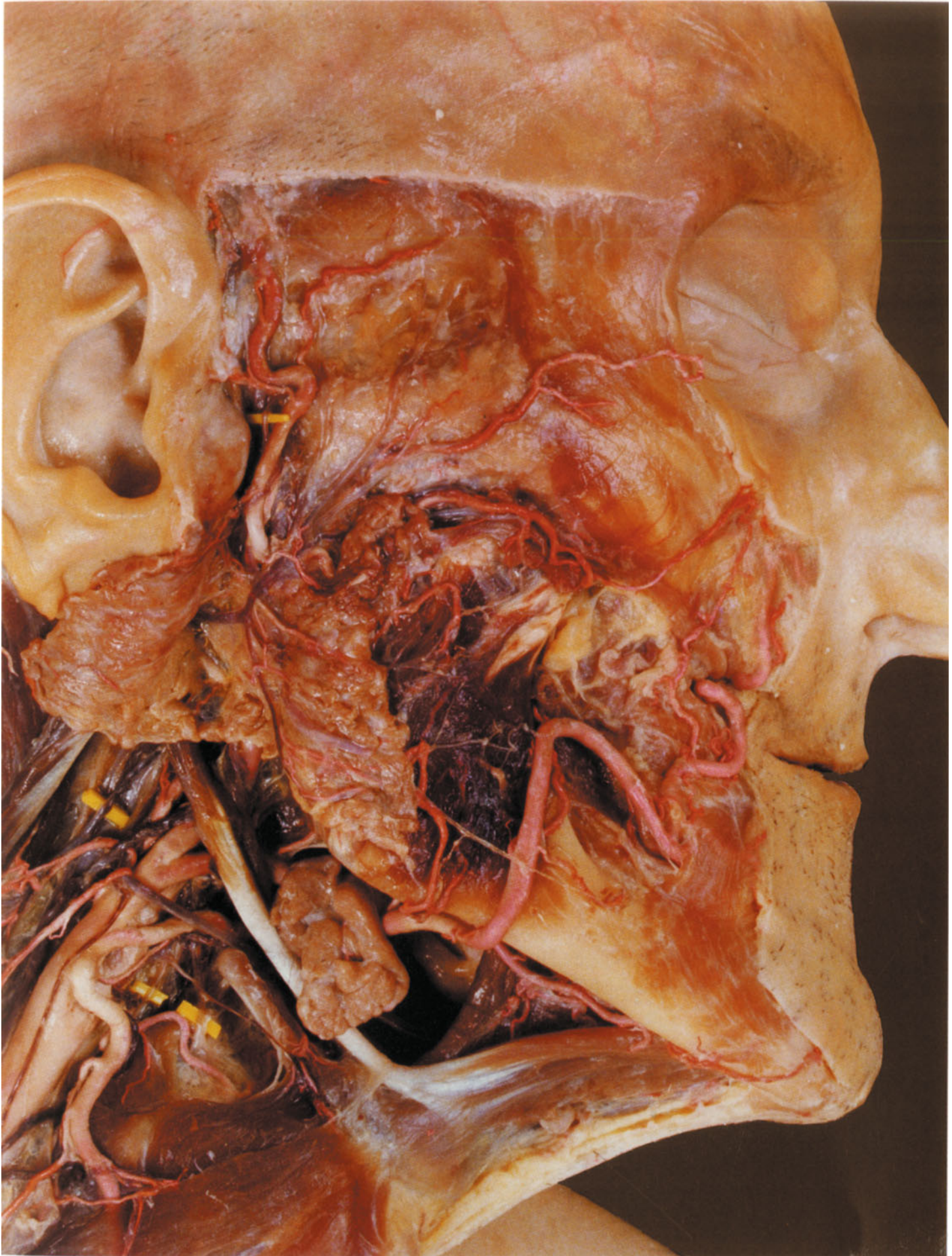
Larger vessels do not cross the **plane of cleavage** in the parotid gland. The gland is supplied from above by **parotid branches** of the **superficial temporal artery** and **transverse facial artery**. The branch of the transverse facial artery arises from the first part of the vessel that is within the substance of the gland.

The **lower portion** of the **superficial part** of the parotid gland is supplied by branches of the **posterior auricular artery**, which here is accompanied by the slender **retromandibular vein**. The **lower portion** of the **deep part** of the gland receives a large branch of the **facial artery**, which also supplies the **masseter muscle**.

The **transverse facial artery** is accompanied by two **zygomatic branches** of the facial nerve and passes to the deep surface of the **accessory parotid gland**, supplying it with branches. The artery terminates at the surface of the face, where, like all facial arteries, it forms extensive **anastomoses**. A particularly large anastomosis with the **facial artery** is shown.

The **zygomatico-orbital artery** in this specimen is a branch of the **transverse facial artery**. It runs a short distance beneath the **masseteric fascia**, which is thickened in this area, before passing to the orbit and anastomosing with the palpebral branches of the **ophthalmic artery**.

As is often the case, the **facial nerve** splits within the parotid gland into two typical divisions but does not form a true **parotid plexus** (see text for Fig. 38).



The lateral facial region is comprised of the **buccal region** and the **parotid-masseter region**. The parotid gland has been removed to display the full extent of the **retromandibular fossa**. It is separated from the **parapharyngeal space** by the **styloid process** and the two deeper muscles that arise from it.

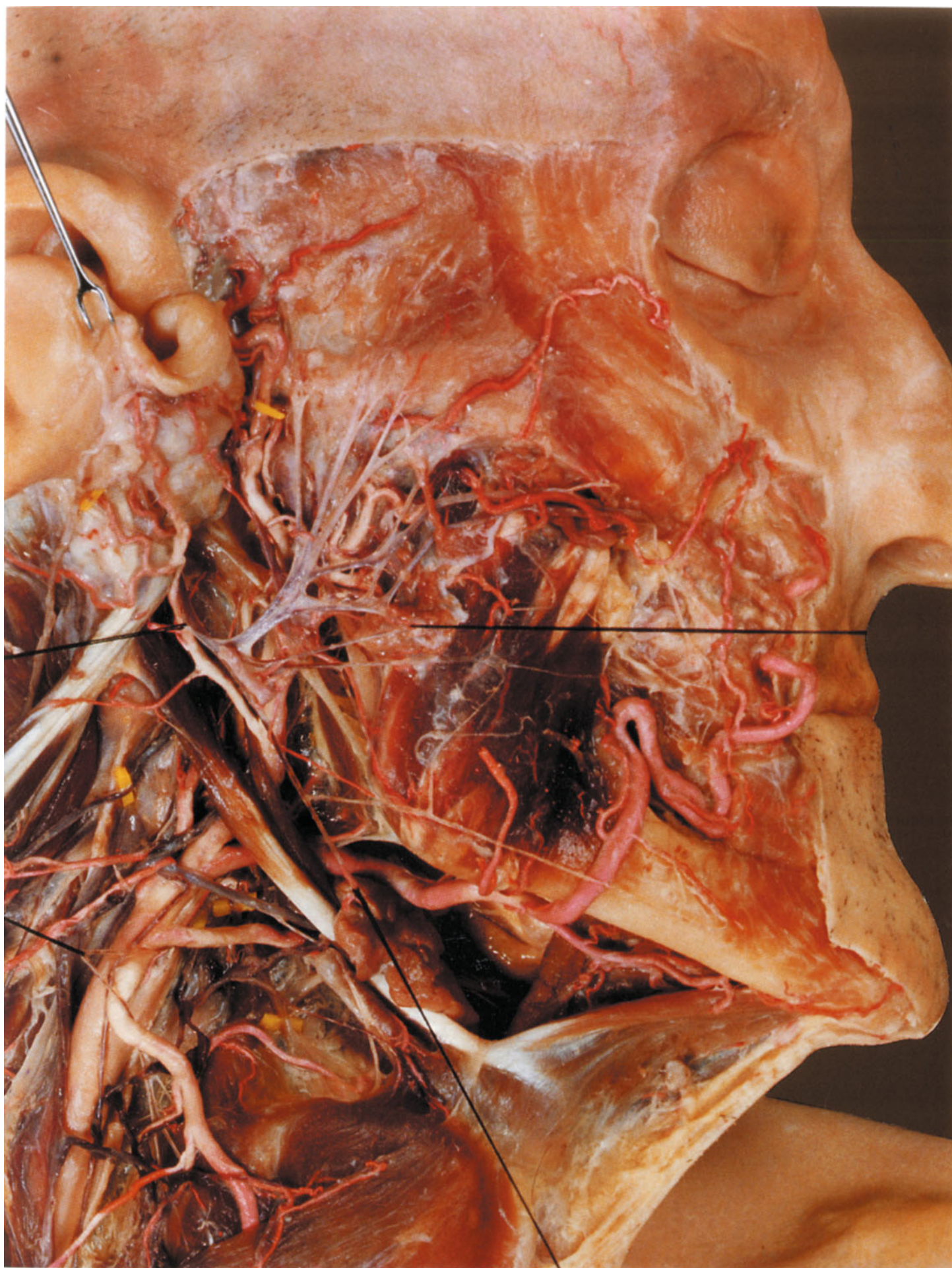
The **stylomandibular ligament** stretches from the tip of the **styloid process** to the **mandibular angle**, and the **styloglossus muscle** originates above it. Between that muscle and the **stylopharyngeus muscle**, the **ascending palatine artery**, derived from the facial artery, passes upward to the pharynx. The **stylohyoid muscle** crosses anterior to the external carotid artery.

The **facial nerve** emerges from the **stylomastoid foramen** between the **styloid process** and **mastoid process** and immediately gives off the tagged **posterior auricular nerve**. The facial nerve shows its typical division into a **superior** and **inferior main branch** (see text of Fig. 38). Both intra- and extraglandular **anastomoses** are present among the branches.

The **masseter muscle** is covered by a very thin muscular **fascia**, which has been removed. At the posterosuperior border of its superficial part, the fascia is thickened to form a **fibrous plate** that extends downward from the **zygomatic arch** and **temporomandibular joint capsule**, where it is firmly attached to the deep surface of the **parotid gland**. This plate has been resected at the site where the **transverse facial artery** runs below it.

Besides the **maxillary artery**, the **masseter muscle** is supplied by large superficial branches from the **facial artery** and **superficial temporal artery**.

The **earlobe** has been elevated to show the distribution of the **posterior auricular artery** and the relation of the **meatal cartilage** to the **mastoid process**. The **auricularis profunda** of the maxillary artery enters the ear canal through the **cartilaginous notch** of the **acoustic meatus**.



The multiple anastomoses among the arteries of the head allow for considerable **variation** in the **origins** and **distribution** of individual vessels without significant functional consequences. Thus, the blood supply to the temporal region in this specimen is derived from an accessory **middle temporal artery** and a high **frontal branch** of the **superficial temporal artery**, and the **zygomatico-orbital artery** does not arise from the superficial temporal artery but from the **transverse facial artery**.

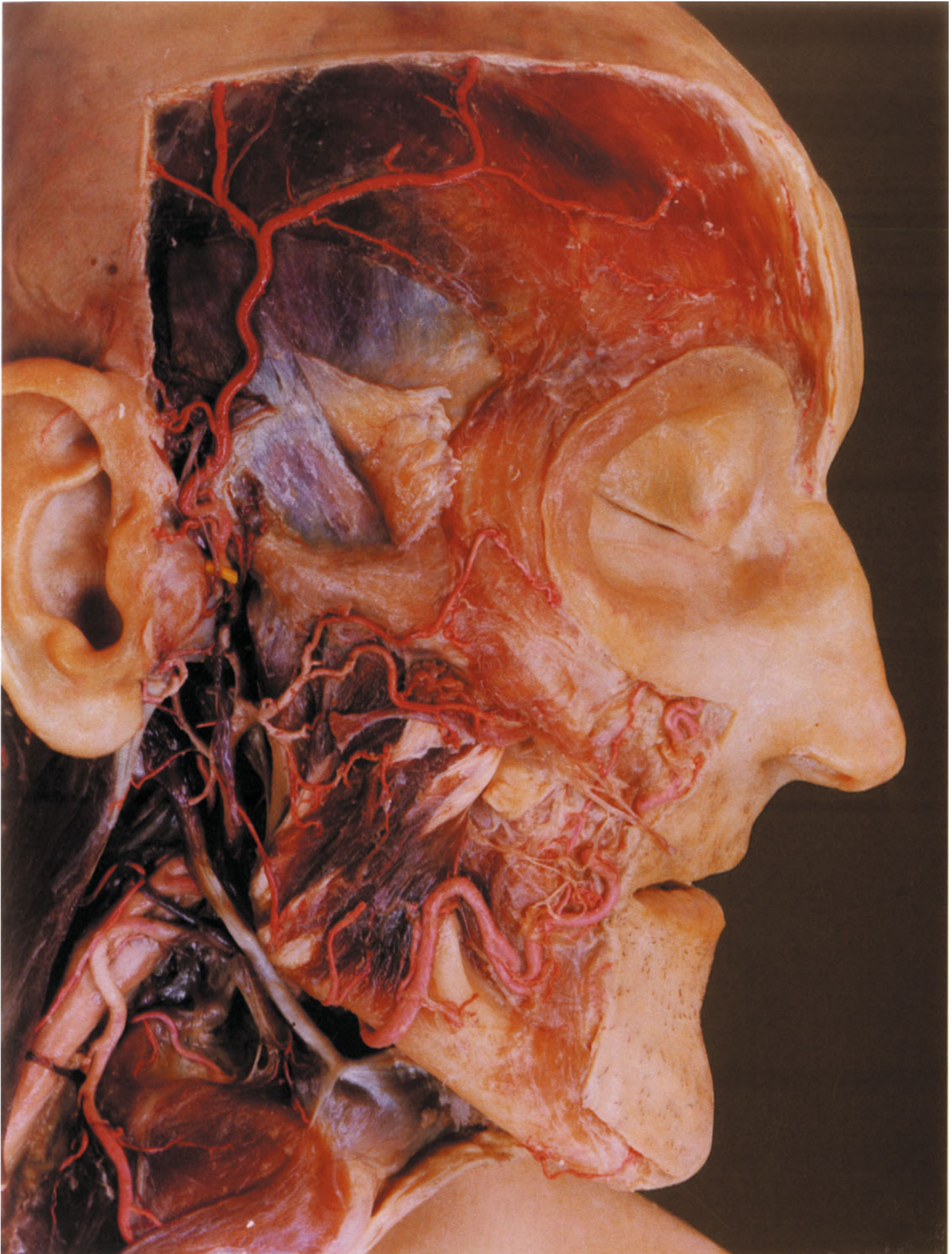
The **deep layer of the stratum subcutaneum** has been removed over the **epicranial muscles** so that the **frontal belly** of the **occipitofrontalis muscle** can be seen over the full width of the forehead. The temporal side of this muscle borders on the **temporoparietalis muscle**, which has been resected at the level of the **temporal line** of the skull along with part of the **auricularis superior muscle**. The **auricularis anterior muscle** has also been partially removed, and the exposed **superficial layer** of the **temporal fascia** has been reflected with the underlying **fat pad** to show the **deep layer**.

The **two layers** of the temporal fascia separate below a superiorly convex **line** running from the **mastoid process** toward the **supraorbital margin**. They are united when they emerge from the **interlinear zone** of the **parietal bone** and are again united when they attach to the upper border of the **zygoma**. The interfascial fat-filled space is traversed by the **middle temporal artery** on its way to the **temporalis muscle**.

Besides the numerous resected **parotid branches**, the **retromandibular fossa** contains the **retromandibular vein** and the terminal divisions of the **external carotid artery**.

The **superficial part** of the **masseter muscle** has been separated from the **deep part** to better demonstrate its external vascular supply.

A notable feature in the **buccal region** is the relatively large **anastomosis** connecting the **facial artery**, **transverse facial artery**, and **infraorbital artery**.



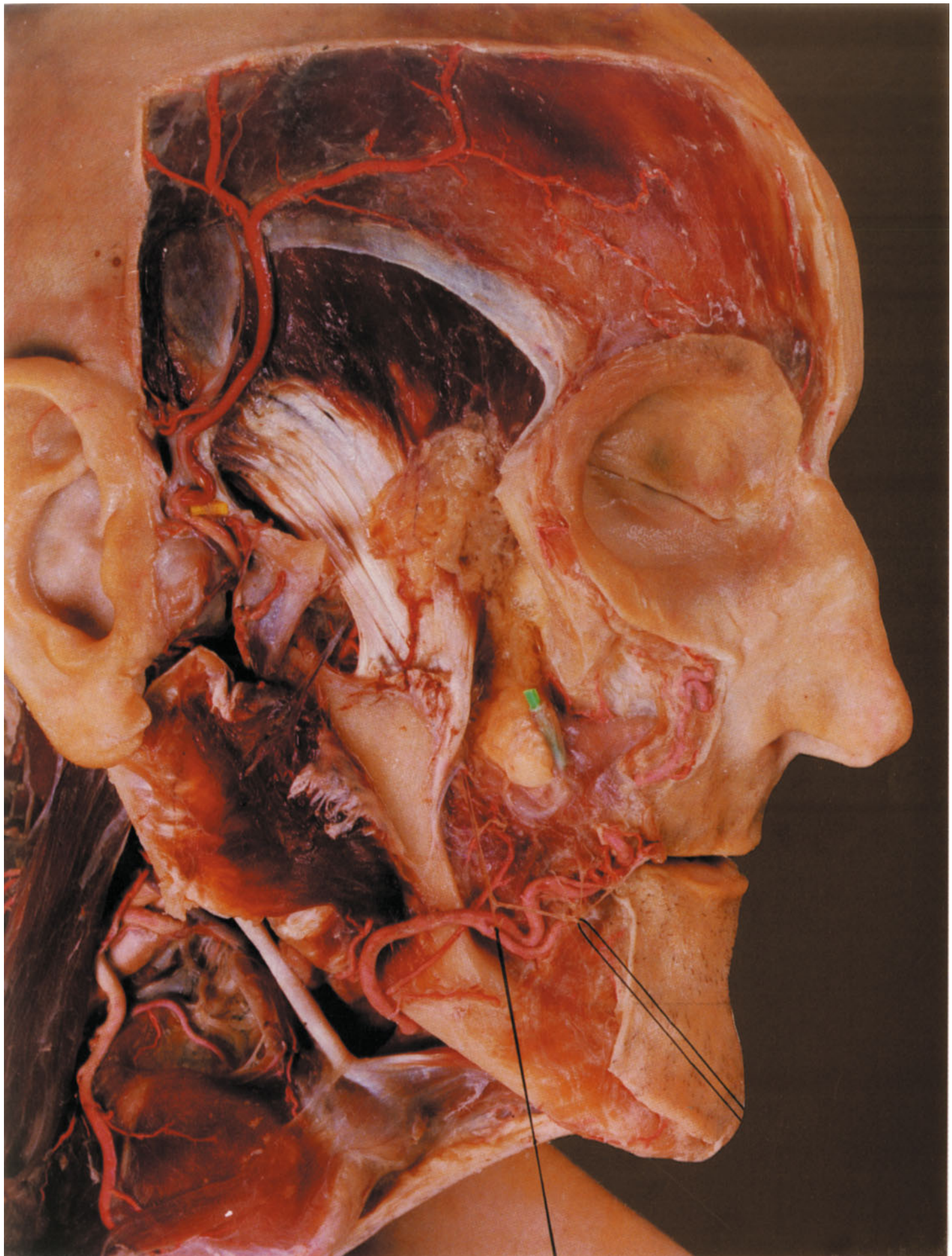
The **zygomatic arch** has been resected in front of the **temporomandibular joint** and re-flected downward on the attached **masseter muscle**. The **temporal fascia** has also been released from its attachment to the upper border of the zygomatic arch, leaving only the part that supplements the skeletal attachment of the **temporalis muscle**.

The **temporalis muscle**, the anterior part of the **mandibular ramus**, and a large portion of the **buccal fat pad** (of BICHAT) have thus been exposed.

Most of the **buccal fat pad** lies behind the **maxillary tuberosity**. It has a **pterygoid process** that extends far backward, passing over the **medial pterygoid muscle** and medial to the mandibular attachment of the **temporalis muscle**. The large **temporal process** of the fat pad passes upward into the **temporal fossa** and covers the anterior border of the **temporalis muscle**. The part of the fat pad that FORSTER calls the **masseter plug** extends forward past the border of the **masseter muscle**. This structure shows a characteristic relation to the **parotid duct** (of STENO). An expansion from the tendon of the **temporalis muscle** tendon to the **buccinator muscle** separates the masseter plug inferiorly from a space containing the **buccal nerve** and an **anastomosis** between the buccal and facial arteries.

The cutaneous and mucosal branches of the **buccal nerve** are marked with traction threads. Near the angle of the mouth, the **facial artery** gives off small independent branches that form a submucosal vascular ring about the oral fissure – the **oral coronary arteries**.

The insertion of the **temporalis muscle** on the **coronoid process** extends far down the **mandible**, especially on the medial side. Behind it, the **masseteric nerve** passes over the mandibular notch to supply the **masseter muscle**. An accompanying **masseteric branch** of the **maxillary artery** is not present. This accounts for the rich extrinsic vascular supply to the muscle, as shown in the previous figure.



Here the **mandibular ramus** has been resected with the **masseter muscle** and the insertion of the **temporalis muscle**. The **condylar process** has been left in continuity with the **temporomandibular joint** and its **lateral ligament**.

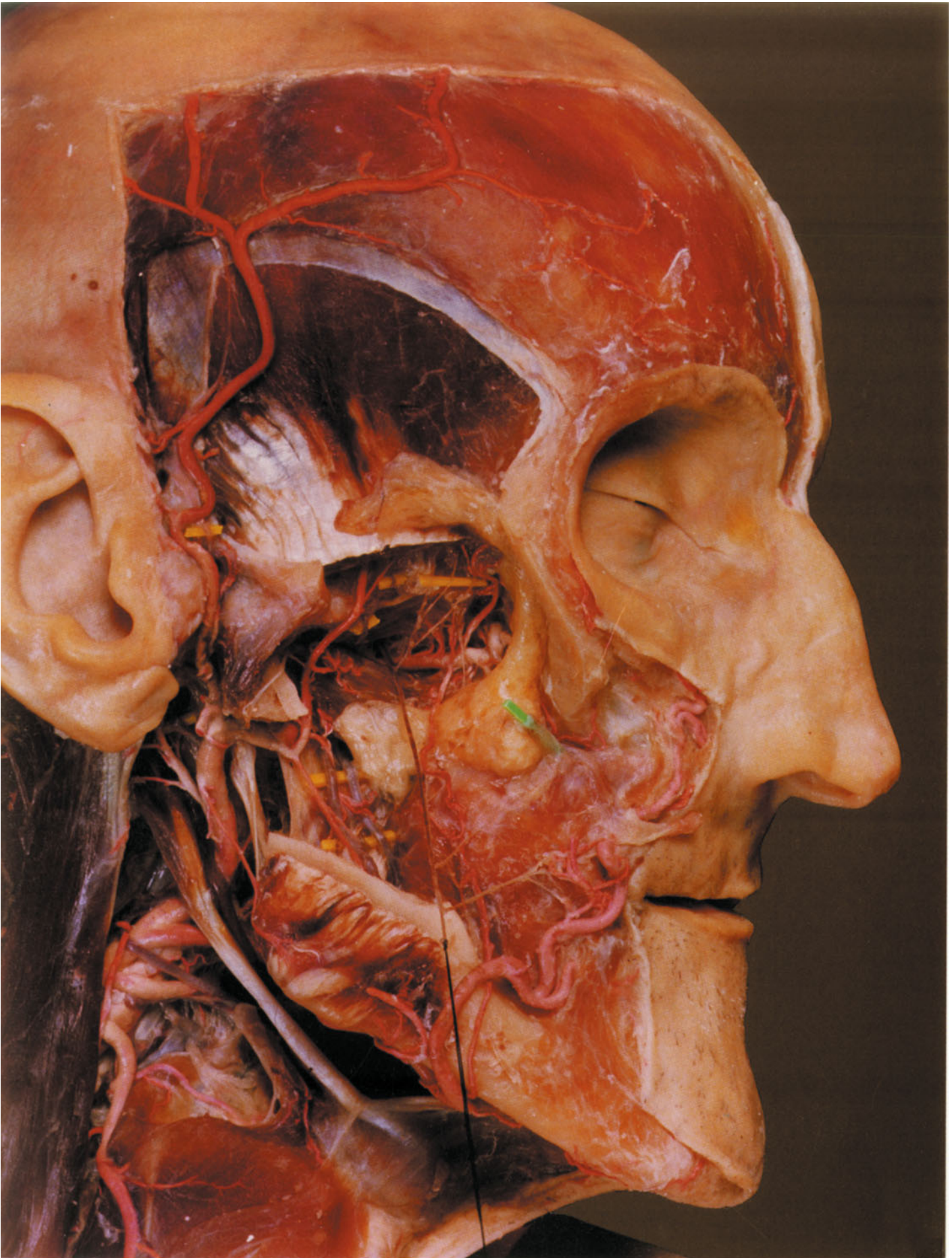
The **maxillary artery** enters the **infratemporal fossa** between the **condylar process** of the mandible and the **sphenomandibular ligament**, which passes from the **angular spine** of the **sphenoid bone** to the area around the **mandibular foramen**.

The **maxillary artery** may run lateral or medial to the **lateral pterygoid muscle** on its way to the **pterygopalatine fossa**. To make its medial position visible, the **superior head** of the **lateral pterygoid muscle**, which often is firmly attached to the **temporalis muscle**, has been partially removed. There the artery gives off several **pterygoid branches** to the muscle as well as the **buccal artery**, which passes between the two heads of the lateral pterygoid in company with the adjacent **buccal nerve**.

The maxillary artery gives off the ascending **anterior deep temporal artery** deep within the fossa before it enters the **pterygopalatine fossa** and gives off its other branches. The **posterior temporal artery** usually takes a somewhat more superficial course, demonstrated here by incision of the overlying inferior belly of the **lateral pterygoid muscle**. In this case the artery gives off the **inferior alveolar artery** to the mandible in addition to its **pterygoid branches**.

The **deep temporal nerves** are in close contact with the bone before entering the muscle, except for the branches that arise from the **buccal nerve**. The most posterior of the deep temporal nerves usually has a common trunk with the **masseteric nerve** that may also supply the **lateral pterygoid muscle**.

The **pterygoid process** of the **buccal fat pad** has retained its correct position between the two pterygoid muscles. Behind it, the **lingual nerve** and **inferior alveolar nerve** are tagged at the point where they pass over the **medial pterygoid muscle** on the way to their target regions.



In this dissection the **condylar process** of the **mandible** and the anterior part of the **temporomandibular joint capsule** have been removed to expose the **articular disk** and the upper part of the joint space.

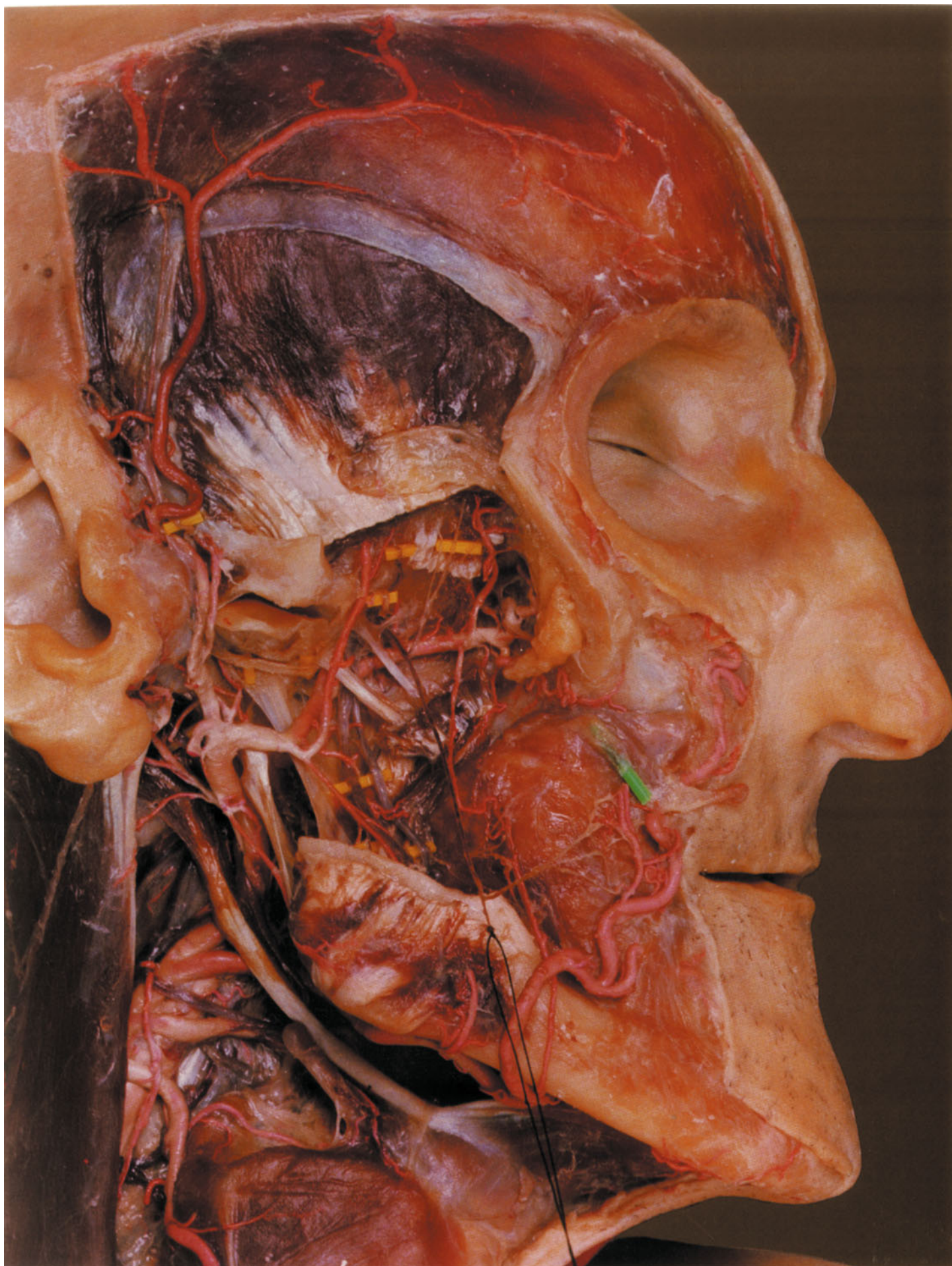
The **lateral pterygoid muscle** has also been removed, leaving portions of its tendinous origins and a **tendon strip** on the **infratemporal crest** at the junction of the vertical **temporal surface** of the greater sphenoid wing with its more horizontal **maxillary surface**. The sinewy **origin** of the **inferior head** of the lateral pterygoid muscle has been left on the **lateral plate** of the **pterygoid process** of the sphenoid bone.

The bulky posterior part of the **medial pterygoid muscle** arising from the **pterygoid fossa** has also been resected. On its medial surface, the medial pterygoid muscle bears a **tendinous plate** attached to the medial layer of the pterygoid process and in contact with the tensor veli palatini muscle. The **tensor veli palatini** is covered by a connective tissue layer that is continuous posteriorly with the **sphenomandibular ligament**.

The protuberant **buccinator muscle** slightly overlaps the intact anterior border of the **medial pterygoid**, which arises from the **lateral plate** of the **pterygoid process**.

The intact **temporal process** of the **buccal fat pad** has been displaced forward at its root to demonstrate the interior of the **pterygopalatine fossa**. The **pedicle** of the fat pad, which projects into the fossa, has been removed.

The **sphenomandibular ligament** descends from the **spine** of the **sphenoid bone** behind the **foramen spinosum** of the greater sphenoid wing to the lingula of the mandibular foramen, while the **pterygospinal ligament** (of CIVININI) passes to an homonymous spine on the **lateral plate** of the **pterygoid process**. This ligament may be considerably stronger than the one in this specimen and it is sometimes ossified, contributing to the formation a **pterygospinal foramen**.



In the field described in Fig. 44, the **maxillary artery** is visible over its entire extent. After arising from the **external carotid artery**, it crosses lateral to the **styloid process** and invariably passes between the **neck of the mandible** and the **sphenomandibular ligament** to enter the **infratemporal fossa**.

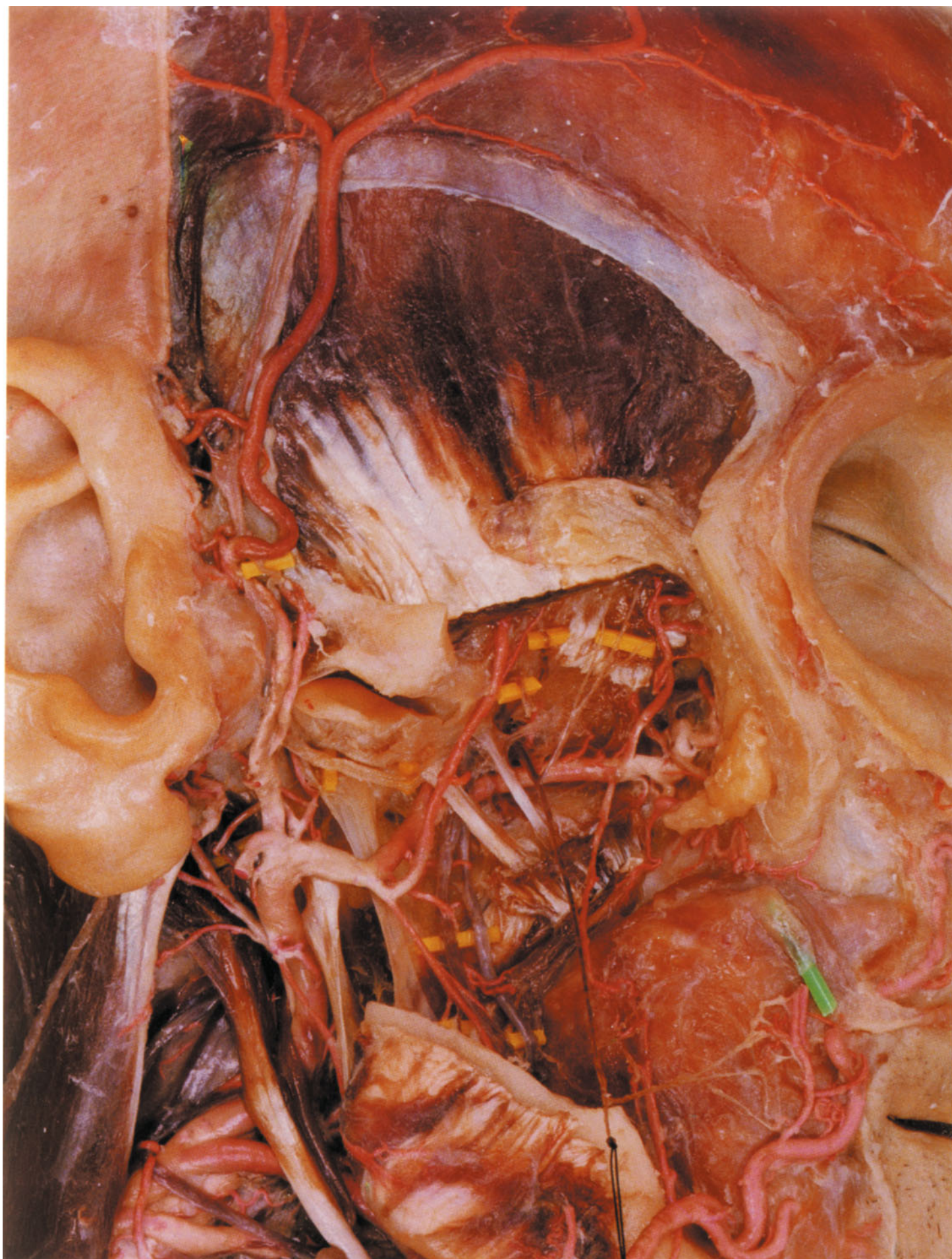
When the **maxillary artery** is deeply placed, as in this specimen, it is related to the **inferior alveolar nerve** and **lingual nerve**, which it usually crosses on the lateral side. The two nerves proceed from the **foramen ovale** to the lateral surface of the **medial pterygoid muscle**. The **lingual nerve** receives the **chorda tympani** from behind after crossing medial to the **sphenoid spine**, and the **inferior alveolar nerve** gives off the tagged **mylohyoid nerve** before entering the mandibular foramen.

The **auriculotemporal nerve** runs backward from the **foramen ovale**. It generally arises by two roots that encircle the **middle meningeal artery** before that vessel enters the **foramen spinosum** of the skull base.

Just below the foramen ovale, the **medial pterygoid nerve** descends on the lateral surface of the **tensor veli palatini** medial to the **pterygospinal ligament** and supplies that muscle along with the **medial pterygoid**.

The **foramen ovale** is subdivided into an anterior and posterior part by an inconstant structure called the **innominate ligament** (of HYRTL). The anterior opening, which HYRTL called the **porus crotaphiticobuccinatorius**, transmits the **deep temporal nerves** and **buccal nerve**, while the posterior opening transmits all the other foregoing branches of the **mandibular nerve**. The second ligamentous structure shown here has essentially the same bony attachment as the ligament of HYRTL and is probably a variant of it.

The **maxillary artery** leaves the infratemporal fossa through the **pterygopalatine fossa**, in which it gives off several branches that are distributed to the maxilla, palate, orbit, pharynx, and eustachian tube. Much of the blood supply, however, is carried by the **sphenopalatine artery** to the posterior two-thirds of the nasal mucosa.



The **middle meningeal artery** is approached surgically (e.g., in a patient with epidural hematoma) through the **temporal region**, which presents a varying anatomy based on the variable distribution of the **superficial temporal artery**.

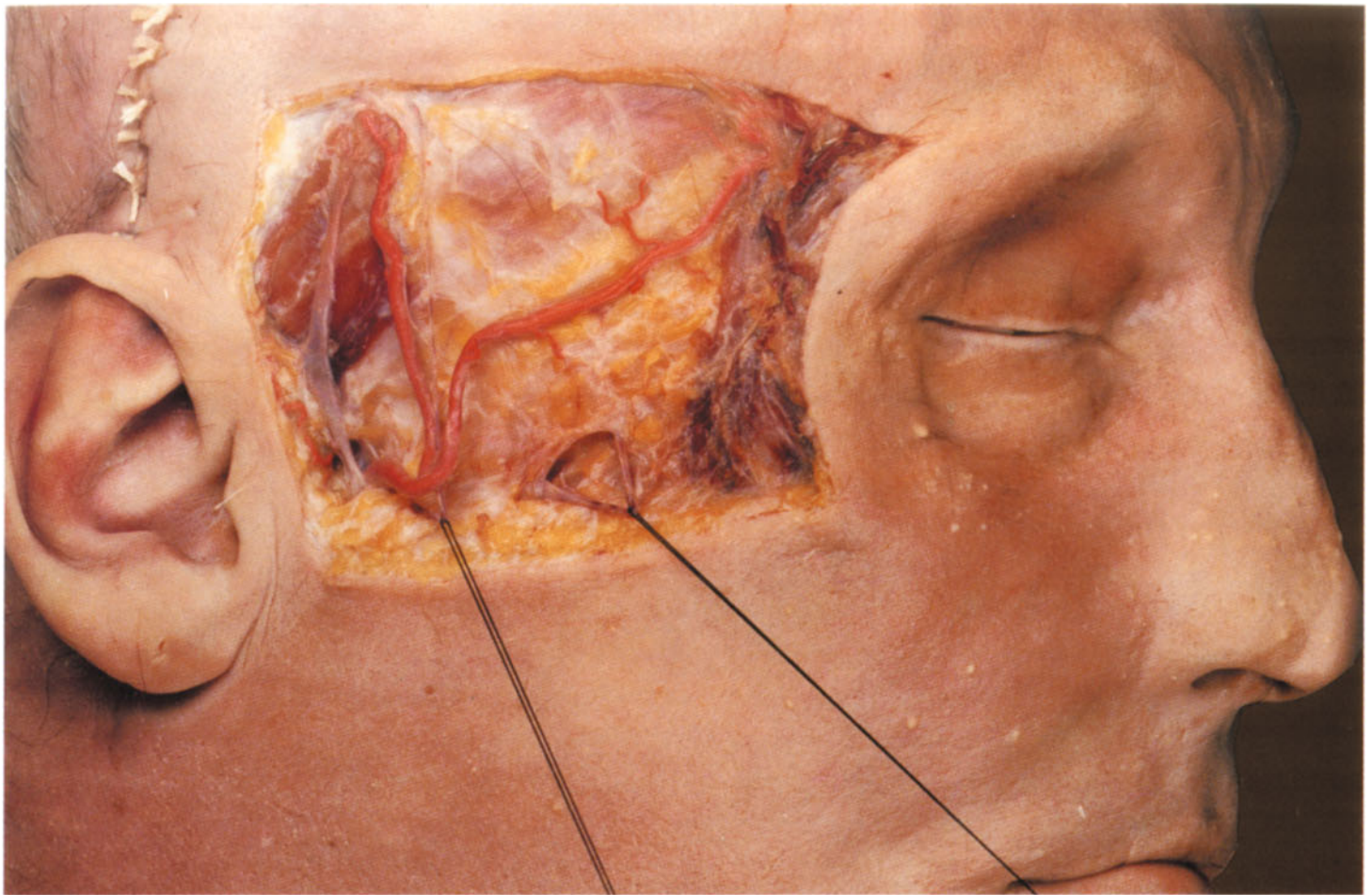
The **frontal branch** of the artery in this case arises a short distance above the **zygomatic arch**, through which it enters the operative field in typical fashion. It lies in the **subcutaneous tissue** while the branches of the **facial nerve** are covered by the **deep layer of the stratum subcutaneum**. This layer is thin over the **auricularis superior** and **anterior muscles** and has been removed.

The **auricularis superior muscle** arises from the **galea aponeurotica** and passes to the medial surface of the auricular cartilage. The **temporoparietalis muscle** also arises from the **galea aponeurotica** and blends with a feltlike portion of the deep layer of the stratum subcutaneum, which also gives origin to the **auricularis anterior muscle**.

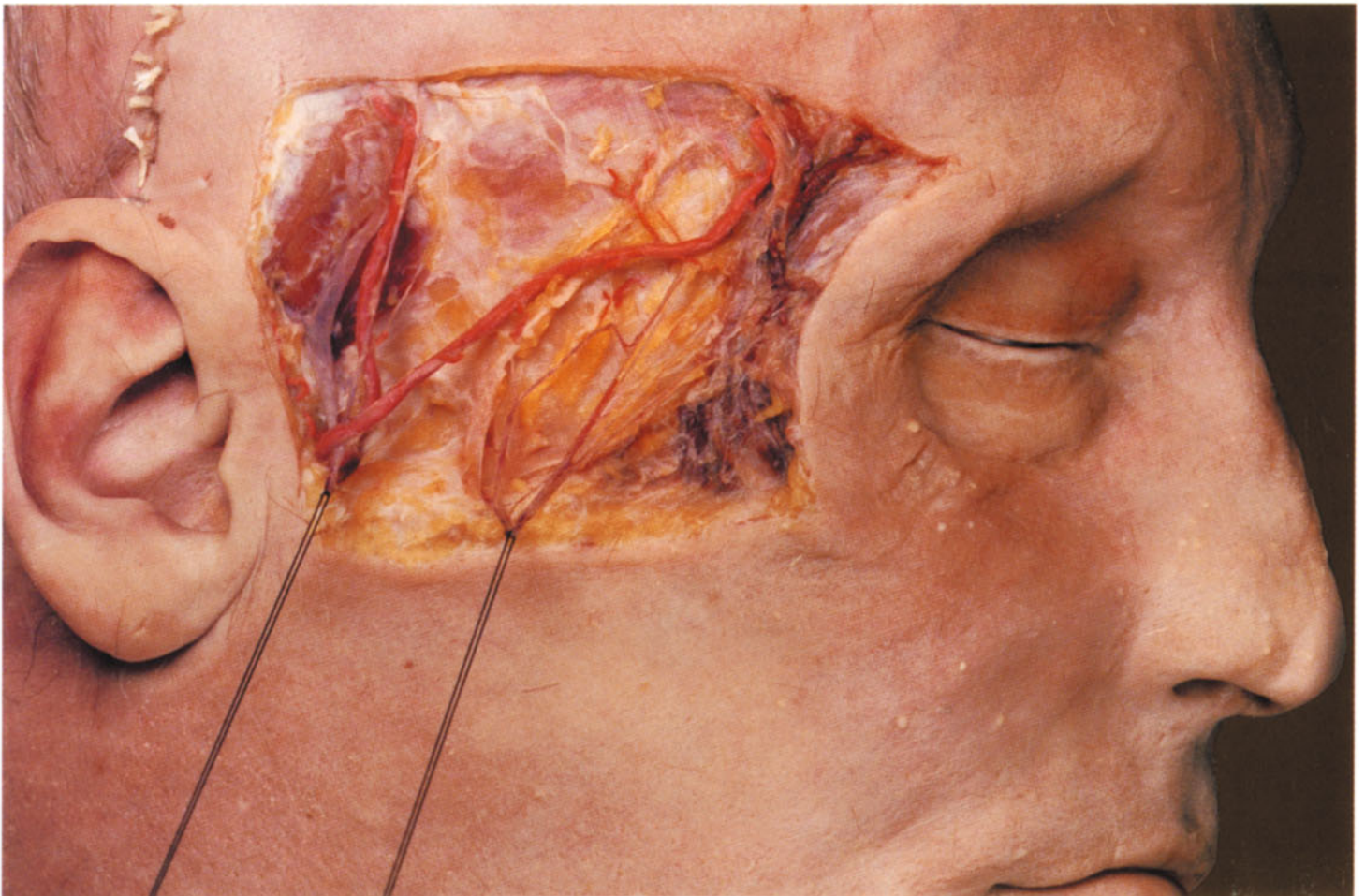
This thickened, feltlike portion of the stratum subcutaneum descends to the **zygomatic arch** and attaches firmly to its outer surface before blending with the firm **parotid fascia**. In this way the **subgaleatic space**, filled with loose connective tissue, acquires a caudal termination that extends from the **external occipital protuberance** to the **supraorbital margin**.

In **Panel A**, the **deep layer of the stratum subcutaneum** has been divided to expose the two **temporal branches** of the **facial nerve**. Traction has been placed on the posterior branch, displacing the **parietal branch** of the **superficial temporal artery** and disclosing the position of the nerve beneath it.

The two **temporal branches** have been dissected further in **Panel B**. The posterior temporal branch gives off two side branches that supply the **auricularis anterior** and **superior muscles**, while the anterior branch gives off side branches that supply the upper part of the **orbicularis oculi** and the **temporoparietalis muscles**. The rest of the nerve proceeds to the **frontal belly** of the **occipitofrontalis muscle**.



A



B

The **intracranial approach** to the **middle meningeal artery** utilizes the area between the infraorbitomeatal and supraorbitomeatal lines. The **infraorbitomeatal line** extends from the infraorbital margin to the upper rim of the external auditory canal, passing just below the superior border of the **zygomatic arch**. The **supraorbitomeatal line** passes through the supraorbital margin parallel to the infraorbitomeatal line.

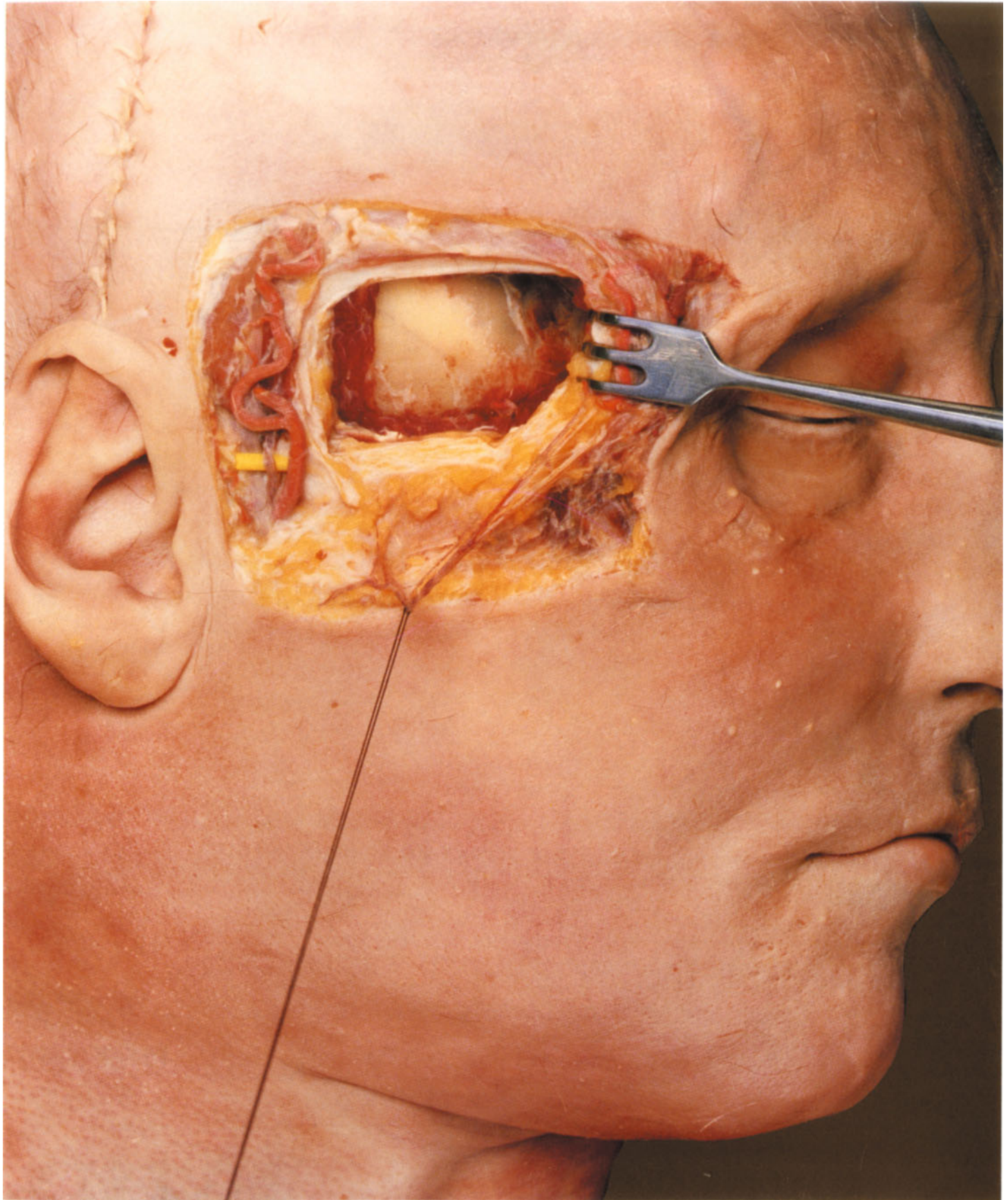
The soft tissues of the **temporal fossa** have been windowed in this dissection, placing the lower margin of the window slightly above the **zygomatic arch**.

In the **superficial layer**, the anterior **temporal branch** of the **facial nerve** has been isolated and retracted laterally. The **temporofrontalis muscle** has been cut at the upper border of this layer and the **auricularis anterior muscle** at its posterior border.

The anterior margin of the window in the **superficial layer** of the **temporal fascia** has been retracted to the posterior border of the **zygomatic bone** to better demonstrate the interior of the temporal fossa. The cut surface of the **fat pad** lying between the **superficial** and **deep layers** of the **temporal fascia** is visible inside the posterior and inferior margins of the window.

The window in the thick **temporalis muscle** exposes the **cranial bones**, from which the **pericranium** has been removed. Visible are the **squamous part** of the **temporal bone** and the **temporal surface** of the **greater sphenoid wing**, which are united at the **sphenosquamous suture**.

The **temporal surface** of the **greater sphenoid wing** forms the deepest point of the **temporal fossa**. It has the shape of an upright rectangle that connects posteriorly with the **squamous part** of the **temporal bone** and anteriorly with the **zygomatic bone**. The narrow top of the rectangle borders on the **parietal bone** and **frontal bone**. The point where the four cranial bones intersect at the upper edge of the rectangle, called the **pterion**, lies just above the anterosuperior corner of the muscle window.



A craniotomy flap has been removed to expose the **middle meningeal artery**. It enters the **cranial cavity** through the **foramen spinosum** and becomes enclosed by the cranial **dura mater**, accompanying it to the internal surface of the **squamous part** of the **temporal bone**. After running a variable distance, it divides into an **anterior branch** and a **posterior branch**; this may occur just past the foramen spinosum or just before the artery leaves the temporal squama.

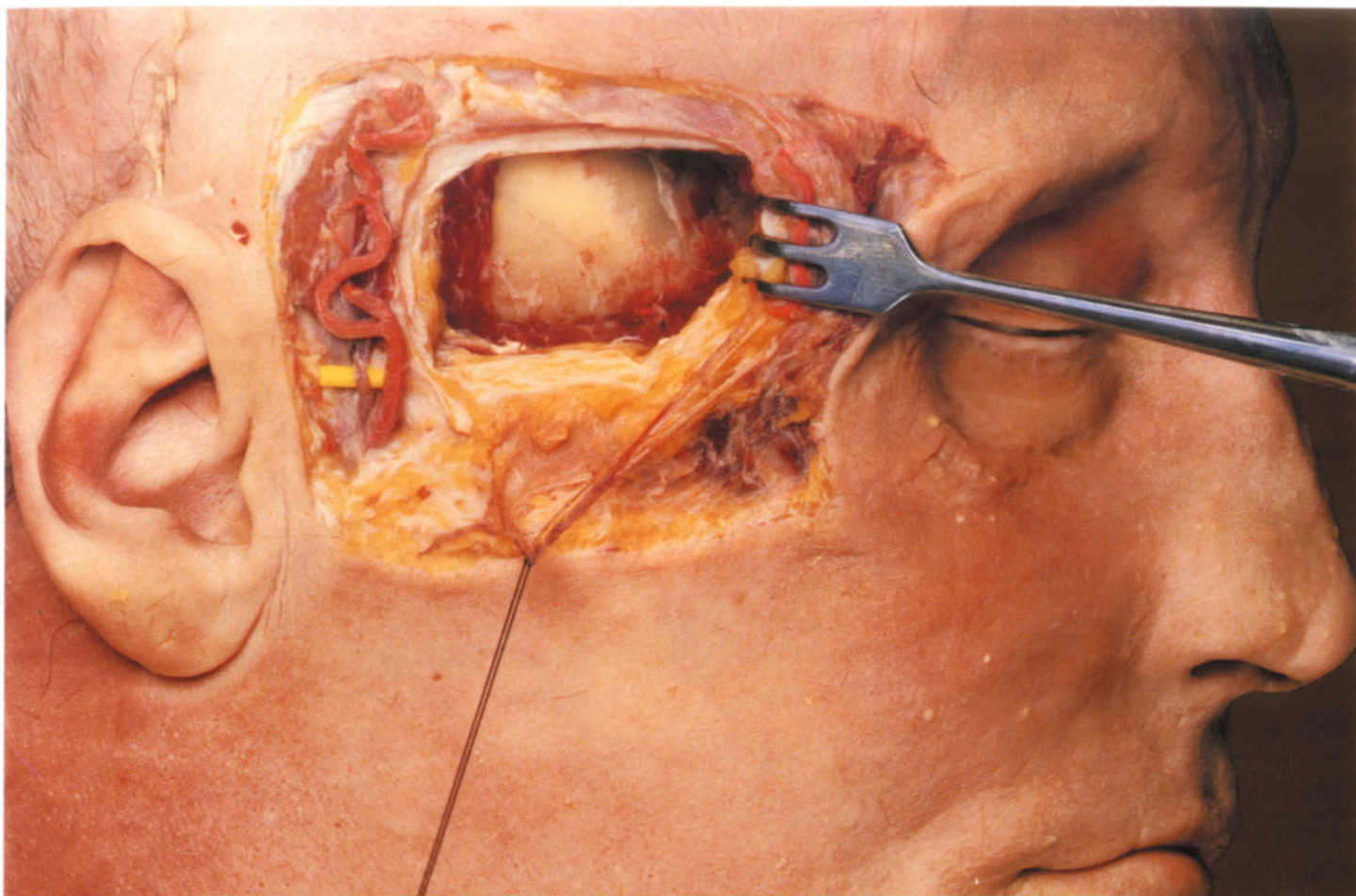
The **anterior branch** (frontal branch) runs to the parietal bone, which it grooves to form the **sulcus** of the **middle meningeal artery**. Initially this groove is very deep, and it forms a true canal in about 50 % of the population.

While on the **squamous part** of the **temporal bone**, the **middle meningeal artery** is still completely enclosed in **dura mater** or lies within a very shallow groove in the bone. The artery itself or its frontal branch is found just behind the **sphenosquamous suture**, which is clearly visible following removal of the **pericranium**. Thus, the area just above the center of the **zygomatic arch** provides an excellent site for approaching and exposing the **middle meningeal artery**.

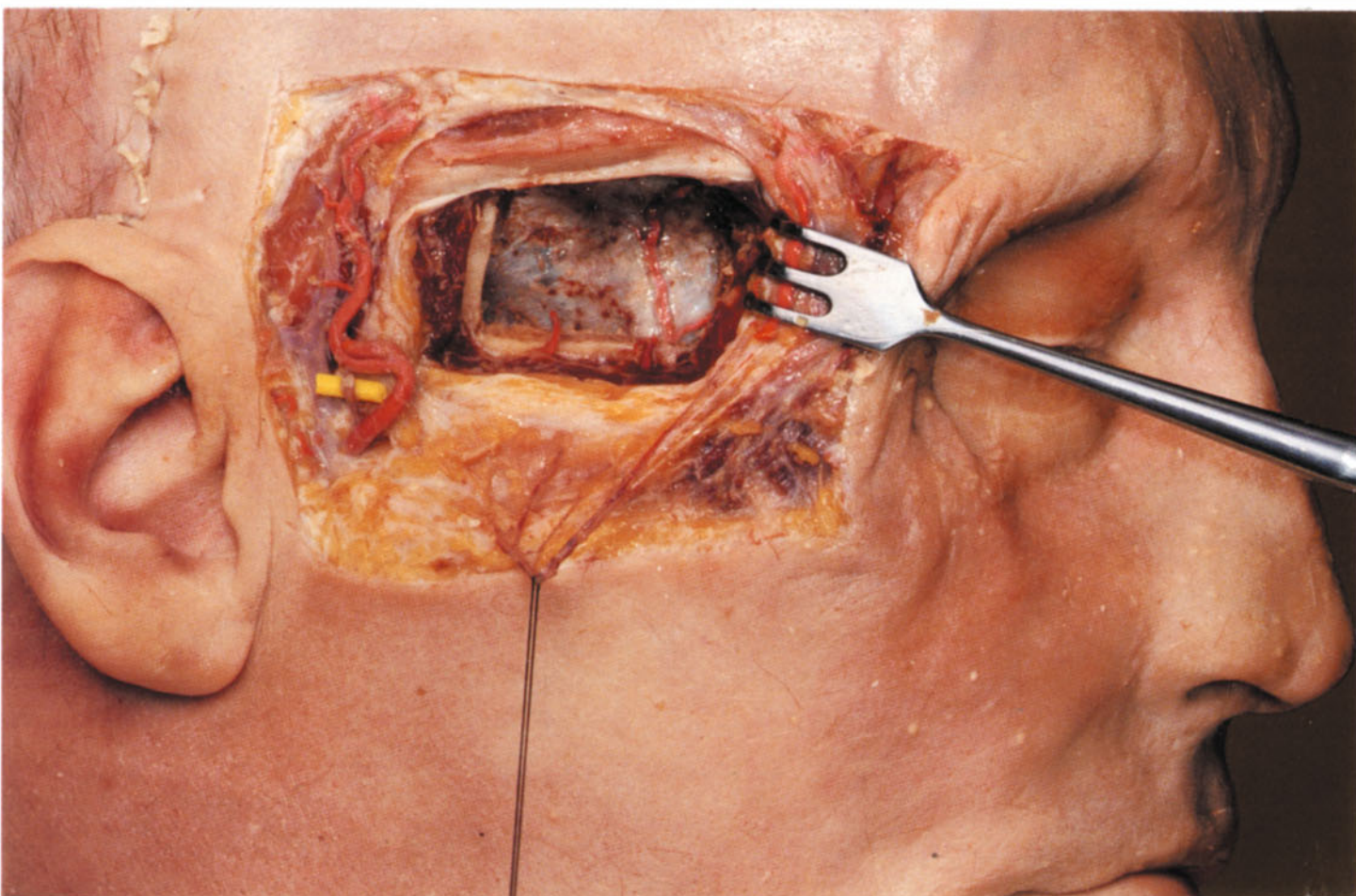
The obscured lower part of the middle meningeal artery in this specimen has been pushed forward somewhat, so it ascends at a slightly steeper angle than usual, and its **parietal branch** arises at a relatively high level.

The point where a **vertical line** from the center of the **zygomatic process** intersects the **supraorbitomeatal line** is perhaps the most reliable spot for locating the **frontal branch** of the **middle meningeal artery**. The artery is very often embedded in bone at that point, however, so the **craniotomy** proposed by KRÖNLEIN is fraught with difficulties.

The many dark spots visible on the **dura mater** represent points where veins enter the bone (the cranial dura mater also serves as the **periosteum**). The larger **arteries** are flanked by **veins** that pass through the **foramen spinosum** to the **pterygoid plexus**.



A



B

The dissection in **Panel A** demonstrates the **orbital fat** and the adjacent **rectus muscles** of the eye. The **levator palpebrae superioris muscle** lies atop the eyeball and sends a fascia-like **expansion** from its tendon to the lateral orbital margin. Above it is the **orbital part** of the **lacrimal gland**. Behind that expansion the orbital part of the gland connects with the **palpebral part**, which is located between the **eyeball** and the **tendinous expansion** of levator palpebrae superioris.

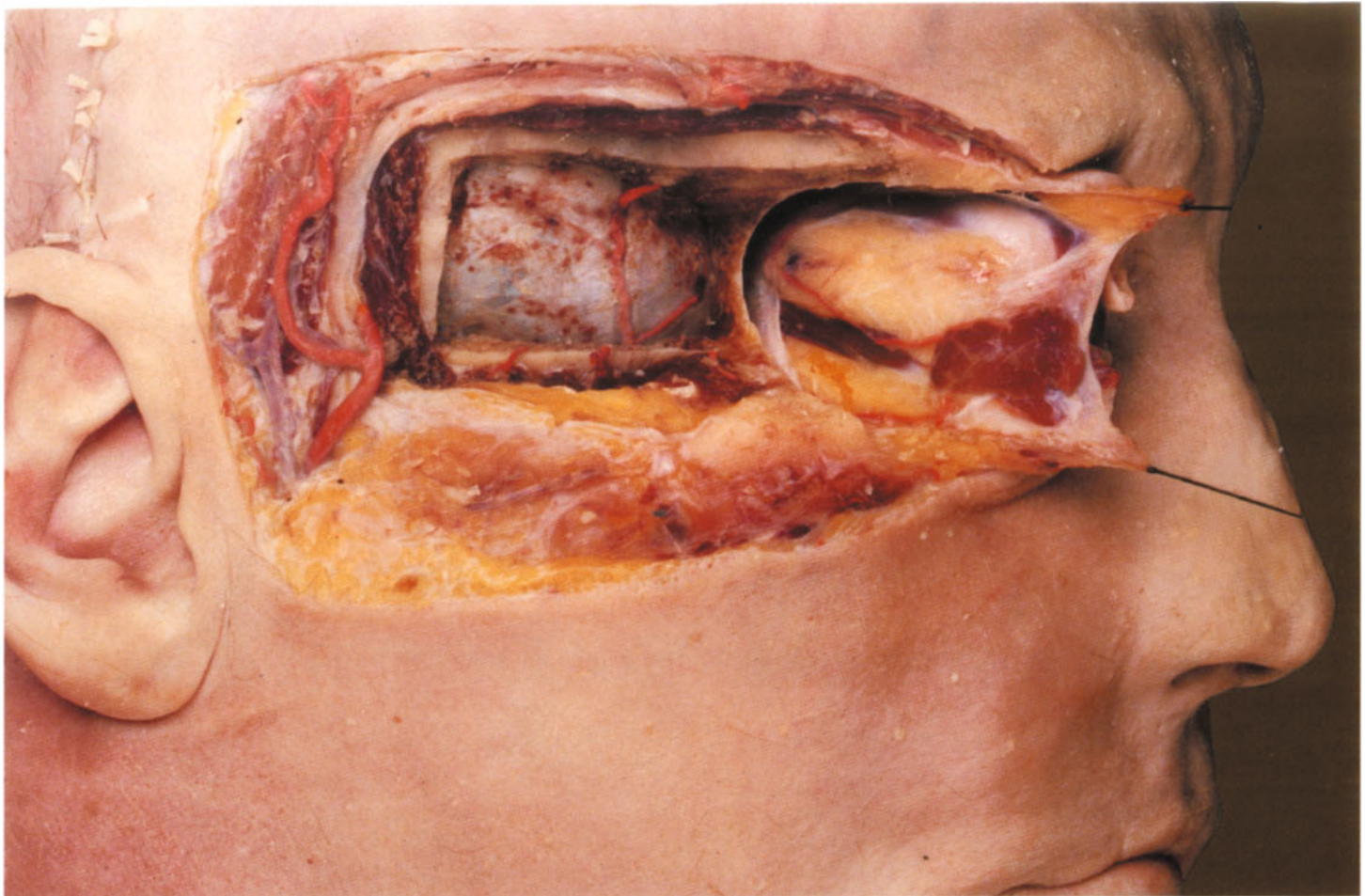
At the upper border of the **rectus lateralis muscle**, the **lacrimal artery** and **nerve** pass to the lacrimal gland, which in this specimen also receives a **branch** of the **infraorbital artery**.

In **Panel B**, the **orbital fat** has been removed and **TENON's capsule** (the fascial sheath of the eyeball) has been elevated from the **eyeball**. At sites where the capsule is pierced by the **orbital muscles**, it is reflected onto each as a short **muscle sheath**. **Fascial slips** from the sheaths of the **lateral rectus muscles** pass forward and are attached to the orbital wall. The **lateral slip** from the lateral rectus muscle sheath is clearly visible in this specimen.

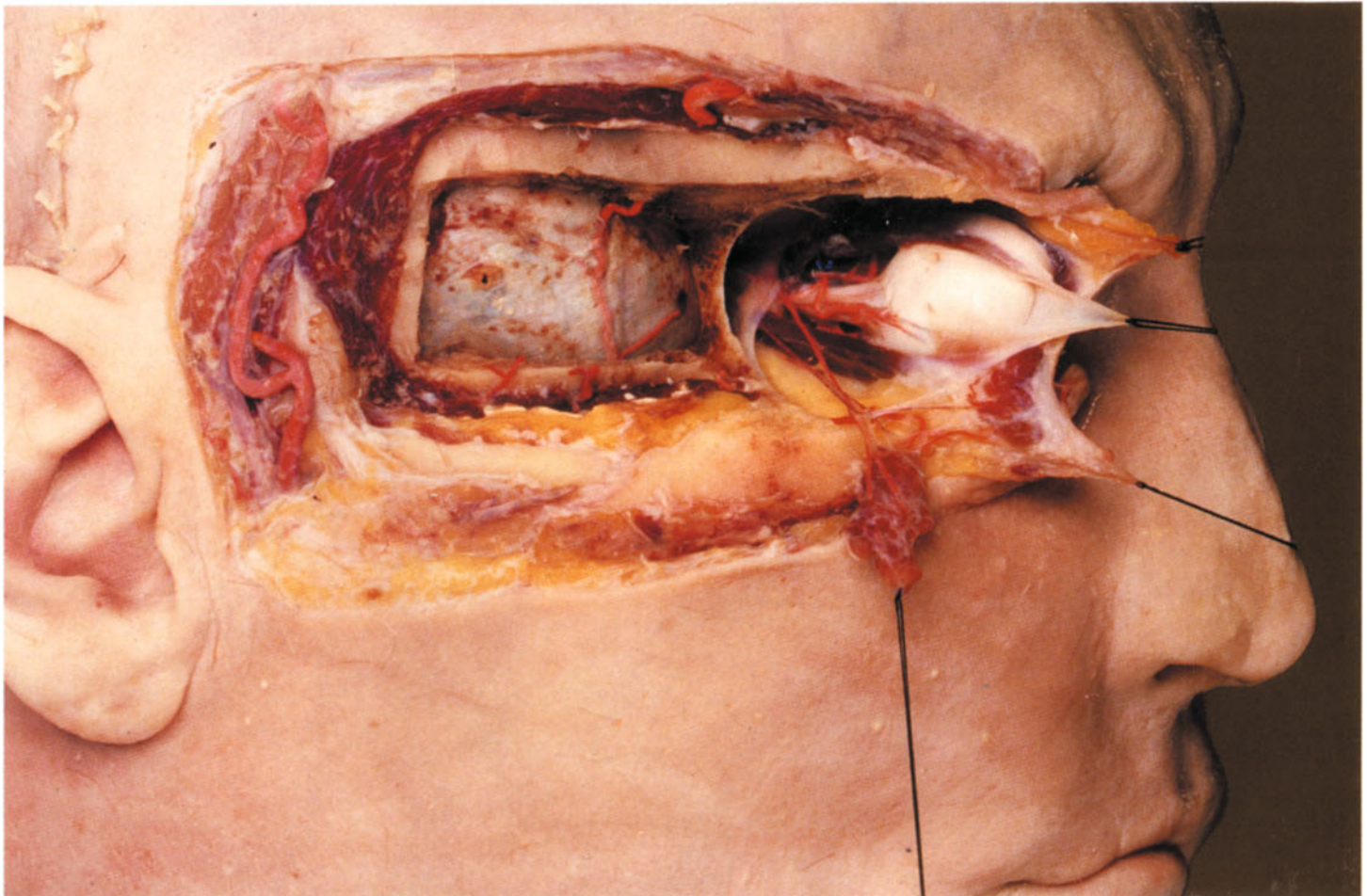
The **orbital part** of the **lacrimal gland** has been separated from its **palpebral part** and retracted with the **lacrimal artery** and **nerve**.

Near the **optic nerve**, the **ophthalmic artery** gives off the **posterior ciliary arteries** and turns medially, generally passing over the optic nerve and rarely passing below it. Thus it lies between the **optic nerve** and the **rectus medialis muscle**. Its visible segment gives off the **anterior ethmoidal artery**, which enters the **anterior ethmoidal foramen** between the **rectus medialis** and **obliquus superior muscles**. The **ophthalmic artery** is accompanied by the **nasociliary nerve** and terminates as the **supratrochlear artery**. The **superior ophthalmic vein** has been looped upward over the initial part of the artery.

Two delicate **short ciliary nerves** are visible on the **outer sheath** of the optic nerve. (See continuation on p. 414.)



A



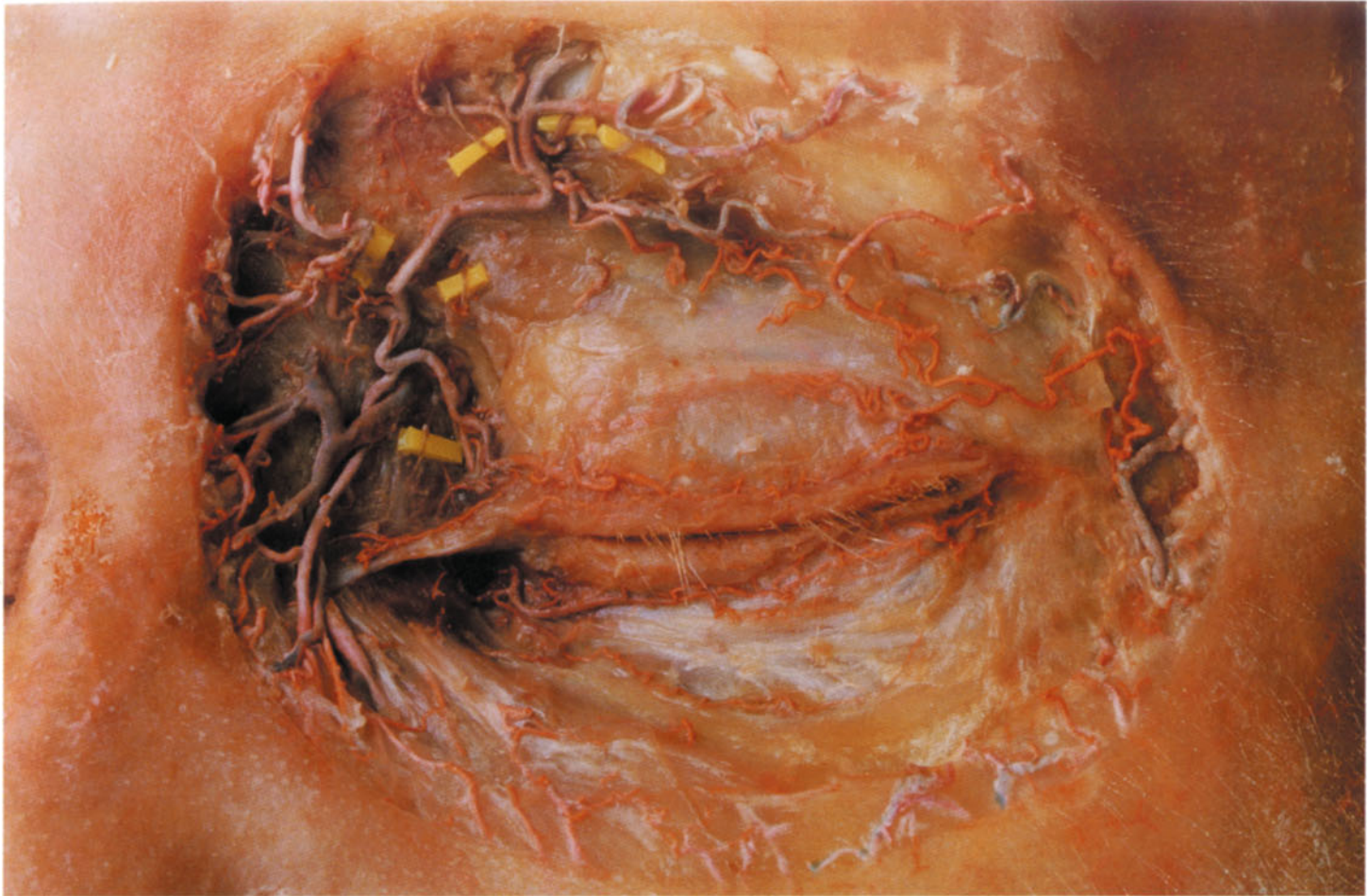
B

The **orbit** is bounded anteriorly by the **orbital septum**. Nerves and vessels that leave the orbital cavity must perforate the attachment of the orbital septum. They are covered initially by the **orbicularis oculi muscle**, which has been removed in this dissection.

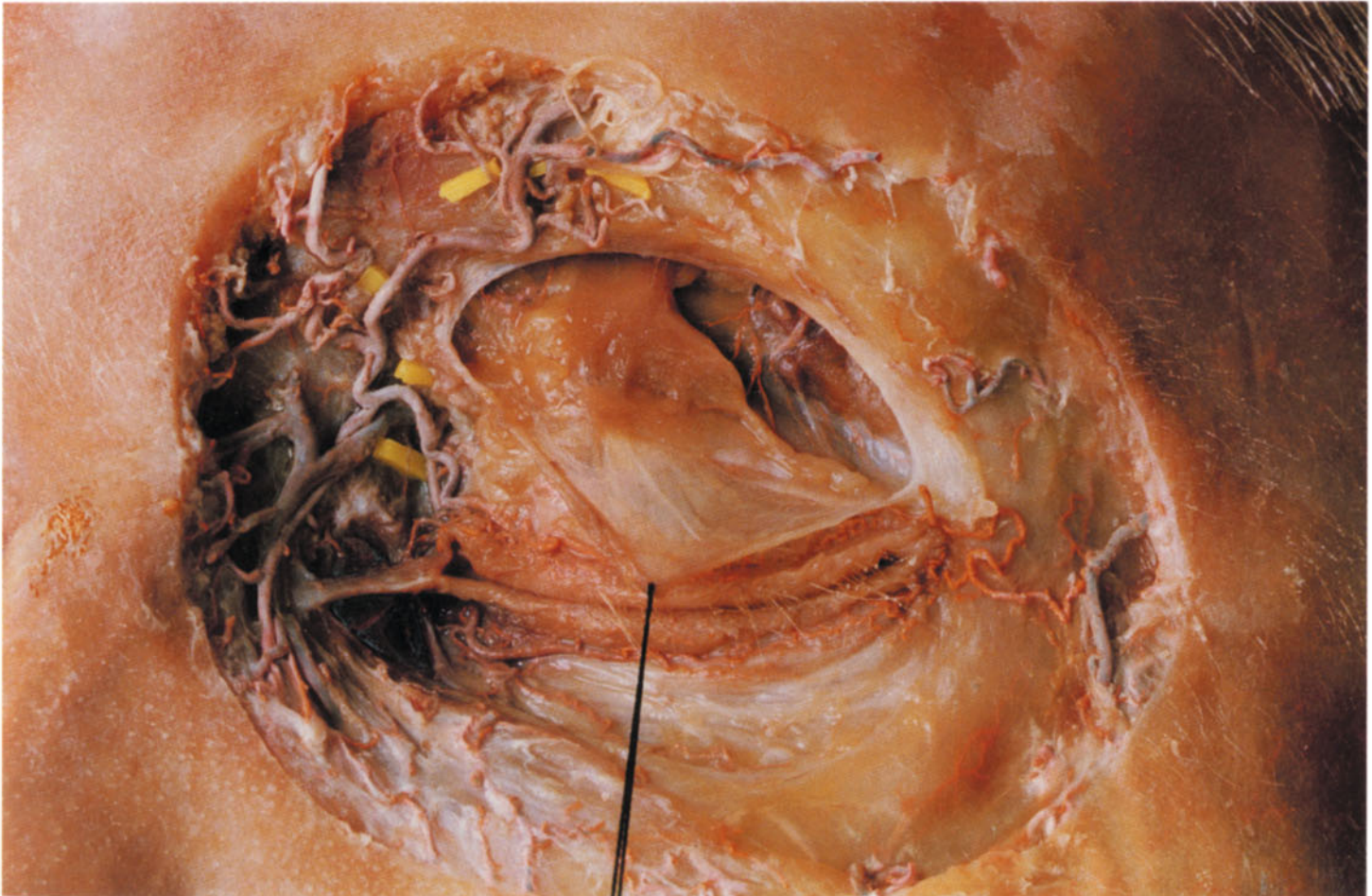
The nerves emerging from the orbit in **Panels A and B** are marked with yellow tags. The **lateral branch** of the **supraorbital nerve** accompanies the **supraorbital artery** through the **supraorbital incisure** (bridged by yellow tags) and divides at once into several large branches. Medial to it, the **medial branch** of the **supraorbital nerve** passes through the **frontal incisure** and is soon accompanied by the **supratrochlear artery**. Above the **trochlea** is the thin **supratrochlear nerve**, which may exchange numerous fibers with the **medial branch** of the **supraorbital nerve** or may even merge with it.

Below the trochlea and adjacent to the **infratrochlear nerve** is the **superior ophthalmic vein**, which is connected to the **angular branch** of the **facial vein** by the **nasofrontal vein**. The **frontal vein** (supratrochlear vein) has been resected along with the medial part of the venous arch to the **middle temporal vein** formed by the **supraorbital vein**. The arteries and veins do not show consistent relationships to one another, but the end of the **ophthalmic artery** consistently leaves the orbit with the lower branch of the **superior ophthalmic vein** and gives off a common trunk for the **medial palpebral arteries**, which join with the **lateral palpebral branches** of the **lacrimal artery** near the lid margins to form the **palpebral arch**. The end of the ophthalmic artery then divides into the **supratrochlear artery** and the **dorsal nasal artery**. An unusually strong anastomotic arch has developed between the **supratrochlear** and **supraorbital arteries**.

In **Panel B**, the **orbital septum** has been divided at the **supraorbital margin** and retracted downward, exposing an area in which the **levator palpebrae superioris muscle** is covered by an extension of the **orbital fat**. Lateral to it, the **orbital part** of the **lacrimal gland** is visible above the **fascial expansion** of the muscle.



A



B

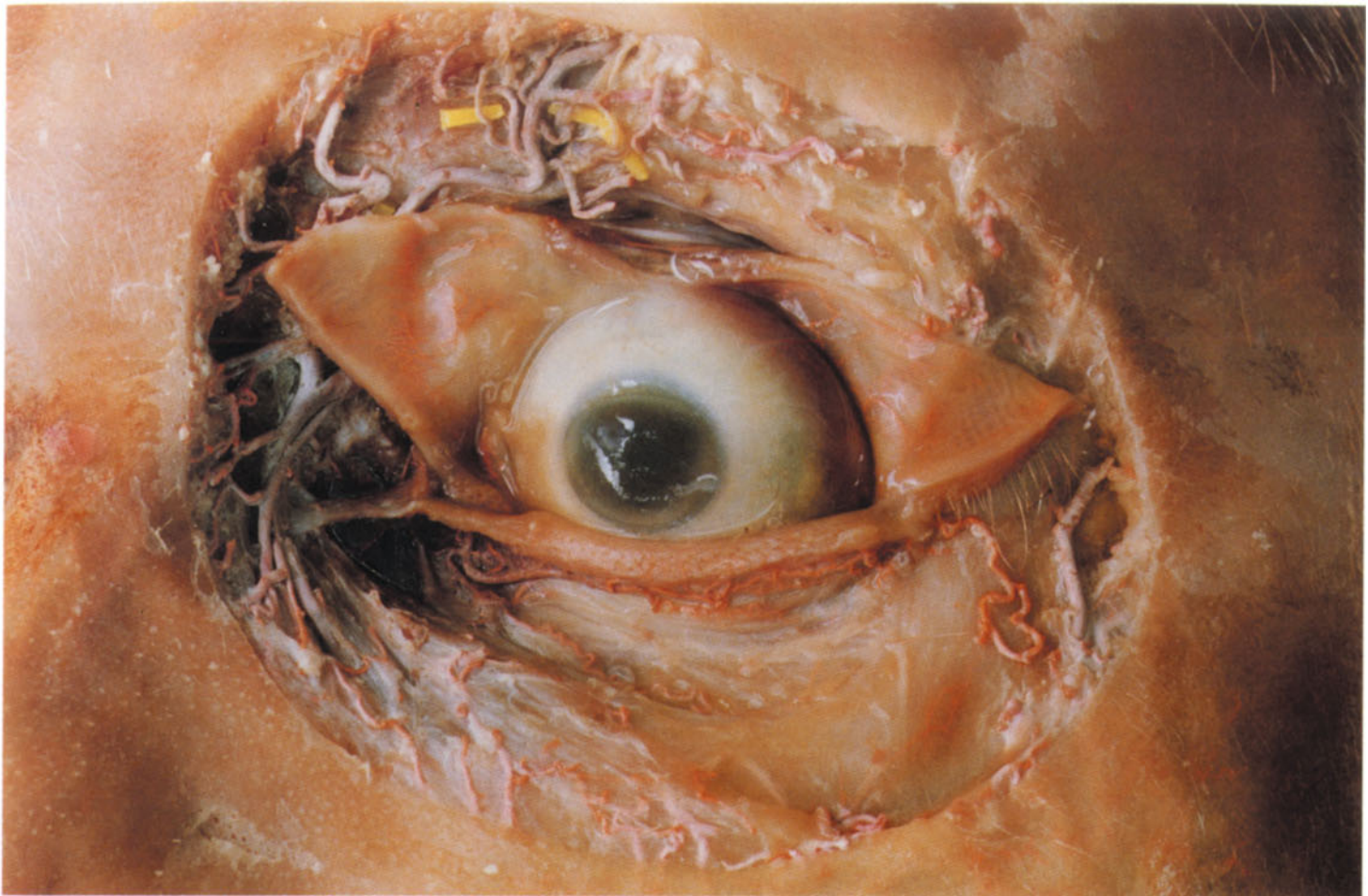
In this figure the **upper eyelid** and **levator palpebrae superioris muscle** have been split and reflected to display the **superior conjunctival fornix**.

With the inner **conjunctival surface** of the upper eyelid exposed, the **superior tarsus** with its embedded **tarsal glands** (of MEIBOM) can be clearly seen. The posterior margin of the tarsus, the **posterior palpebral limbus**, forms a sharp edge at the palpebral fissure marking the junction of the **conjunctiva** with the skin. At the medial end of the tarsus, the **lacrimal puncta** mark the commencement of the **lacrimal canaliculi**, which convey tear fluid to the **lacrimal sac**. This specimen is unusual in that it exhibits a second **lacrimal punctum** (a variant first described by FOLTZ in 1860).

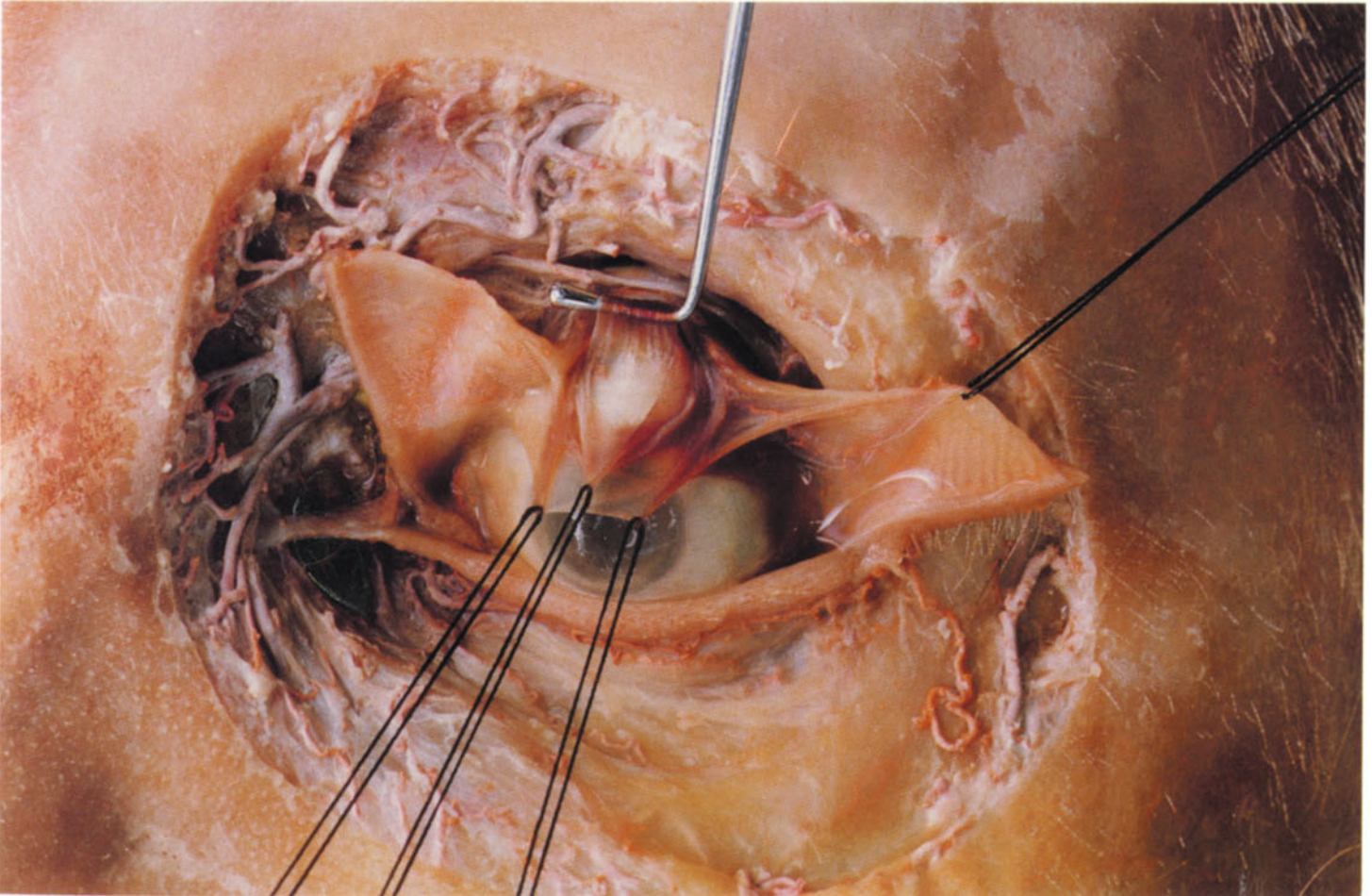
Medial to the normal punctum, the posterior lid margin becomes slightly rounded at the **medial palpebral commissure** and the **medial angle of the eye**, where we find the slight eminence of the **lacrimal caruncle** and the **semilunar conjunctival fold**.

The **conjunctiva** is supplied by **posterior conjunctival arteries** derived from the **palpebral** and **lacrimal arteries**. Of considerable size in the **palpebral conjunctiva**, these arteries form a **vascular network** that is especially dense on the **tarsi**. They are of much smaller caliber in the **ocular conjunctiva** – too fine to be seen with the unaided eye and not visible in this specimen. In the living subject, however, the vessels are freely mobile with the loose conjunctiva, making them easy to distinguish from the **anterior ciliary arteries**.

In **Panel B**, the **conjunctiva** in the **superior fornix** has been divided and pulled forward with two threads. Also, the **muscle sheath** emerging from **TENON's capsule** has been divided at its proximal end and pulled forward to expose the **superior rectus muscle**, which is elevated on a probe just behind its **ocular attachment**. A bundle of the **levator palpebrae superioris muscle** can be seen passing to the **superior fornix** of the **conjunctiva**.



A



B

The posterior surface of the neck, known also as the **nape** or **nucha**, extends from the **supreme nuchal line** and **external occipital protuberance** to a line connecting the **spinous process** of the **seventh cervical vertebra** (vertebra prominens) with the **acromion**. A second line between the two **mastoid processes** that crosses the **spinous process** of the **axis** (epistropheus) subdivides this region into a **posterior cervical region** and an **occipital region** extending to the **lambdoid margin** of the occipital bone.

The nucha is replete with **autochthonous muscles** that are applied to the vertebral arches of the cervical spine between the **transverse** and **spinous processes**. They are a prolongation of the **erector spinae muscle** and are covered by the upper portions of the **sternocleidomastoid** and **trapezius muscles**.

The sternocleidomastoid and trapezius muscles are interconnected at the **superior nuchal line** by connective tissue or, as a common variant, by the **transversus nuchae muscle**. Visible in the interval between the two muscles is the broad band of the **splenius capitis**, which has the same insertion as the **sternocleidomastoid muscle** and extends under cover of that muscle from the **mastoid process** to the **superior nuchal line**.

The **trapezius muscle** arises at the center of the fibroelastic **ligamentum nuchae** and is pierced in that area by the sensory **dorsal rami** of **cervical nerves C3** through **C7**.

Traction threads have been placed to mark the sensory **greater occipital nerve**, **lesser occipital nerve**, and **great auricular nerve**. The **lesser occipital nerve** is accompanied by a cutaneous nerve, usually very thin, supplying the lateral part of the posterior cervical region and the area about the mastoid process and arising from the third cervical nerve: the **second lesser occipital nerve**.

A traction thread at upper left marks the **posterior auricular branch** of the **facial nerve** supplying the muscles of the back of the auricle and the **occipital belly** of the **occipitofrontalis muscle**.



The course of the **lesser occipital nerve** on the right side of this specimen differs from the opposite side in that the nerve passes around a separate **bundle** of the **trapezius muscle** before entering the occipital region. In some cases the nerve may perforate the border of a normally formed **trapezius muscle**. This seems all the more surprising when we consider that much of the course of the nerve above the **punctum nervosum** is covered by the **sternocleidomastoid muscle**.

The **lesser occipital nerve** communicates with the **greater occipital nerve** by the usual anastomosis, and both ascend as they distribute branches from the occipital to the parietal regions. The lesser occipital nerve has a **vicarious relation** to the greater occipital nerve, meaning that the caliber of one nerve varies inversely with the caliber of the other.

The **greater occipital nerve**, accompanied by the **occipital artery**, may emerge through or just below the connective tissue arch between the **trapezius** and **sternocleidomastoid muscles**. Disease of the **occipital lymph nodes** at that site may cause occipital neuralgia.

The **mastoid lymph nodes**, also called the **retroauricular lymph nodes**, are visible on the **mastoid process** near the **posterior auricular branch** of the **facial nerve**. Below them, the **infraauricular lymph nodes** are seen near the **posterior branch** of the **great auricular nerve** at the posterior margin of the **parotid gland**.

The **occipital artery** and **occipital nerves** are embedded in the scalp, which consists only of **skin** and modified **subcutaneous tissue** behind the between the **occipital bellies** of the **occipitofrontalis muscle**.

The **subcutaneous tissue** forms a firm, feltlike layer in this area that is securely attached to the **supreme nuchal line** and to the tendinous origins of the **sternocleidomastoid** and **trapezius muscles**. Neurovascular structures are firmly embedded in the subcutaneous tissue and are difficult to isolate from it by dissection.



The **trapezius** and **rhomboid muscles** – ventral muscles that migrated backward during phylogenic development – have been removed to demonstrate the surface of the **autochthonous back muscles**. Here they are framed by the **levator scapulae** and **sternocleidomastoid muscles**, which are part of the ventral muscle group.

The broad, flat **splenius capitis muscle**, which arises from the **spinous processes** of the lower cervical and upper thoracic vertebrae and inserts along the **superior nuchal line** as far as the **mastoid process**, is covered inferiorly by the **serratus posterior superior muscle**. The **splenius capitis muscle** itself covers most of the substantial muscle mass that is posterior to the short deep nuchal muscles and passes to the **nuchal plane** of the **occipital bone** as the **semispinalis capitis muscle**.

The splenius capitis muscle is bordered laterally by the narrower **splenius cervicis muscle**, whose origin extends two spinous processes lower on the thoracic spine. It inserts on the **transverse processes** of the upper two cervical vertebrae.

The tagged **greater occipital nerve** emerges through the exposed upper part of the **semispinalis capitis muscle** and runs laterally to the **occipital artery**. This vessel occupies a markedly lateral position above the **splenius capitis muscle** and is crossed on the right side by the tagged **lesser occipital nerve**. The **third occipital nerve** passes to the surface at the medial end of the upper border of the **splenius capitis muscle**, usually by piercing the muscle.

From the medial side of the **levator scapulae muscle**, the **dorsal scapular nerve** enters the plane between **serratus posterior superior** and the **rhomboids muscles**, which have been resected here.

The **accessory nerve** runs lateral to the **levator scapulae muscle** with a **trapezian branch** of the **cervical plexus**, which originally were covered only by the **trapezius muscle**. The **transverse cervical artery** lies in fatty tissue anterior to the accessory nerve.



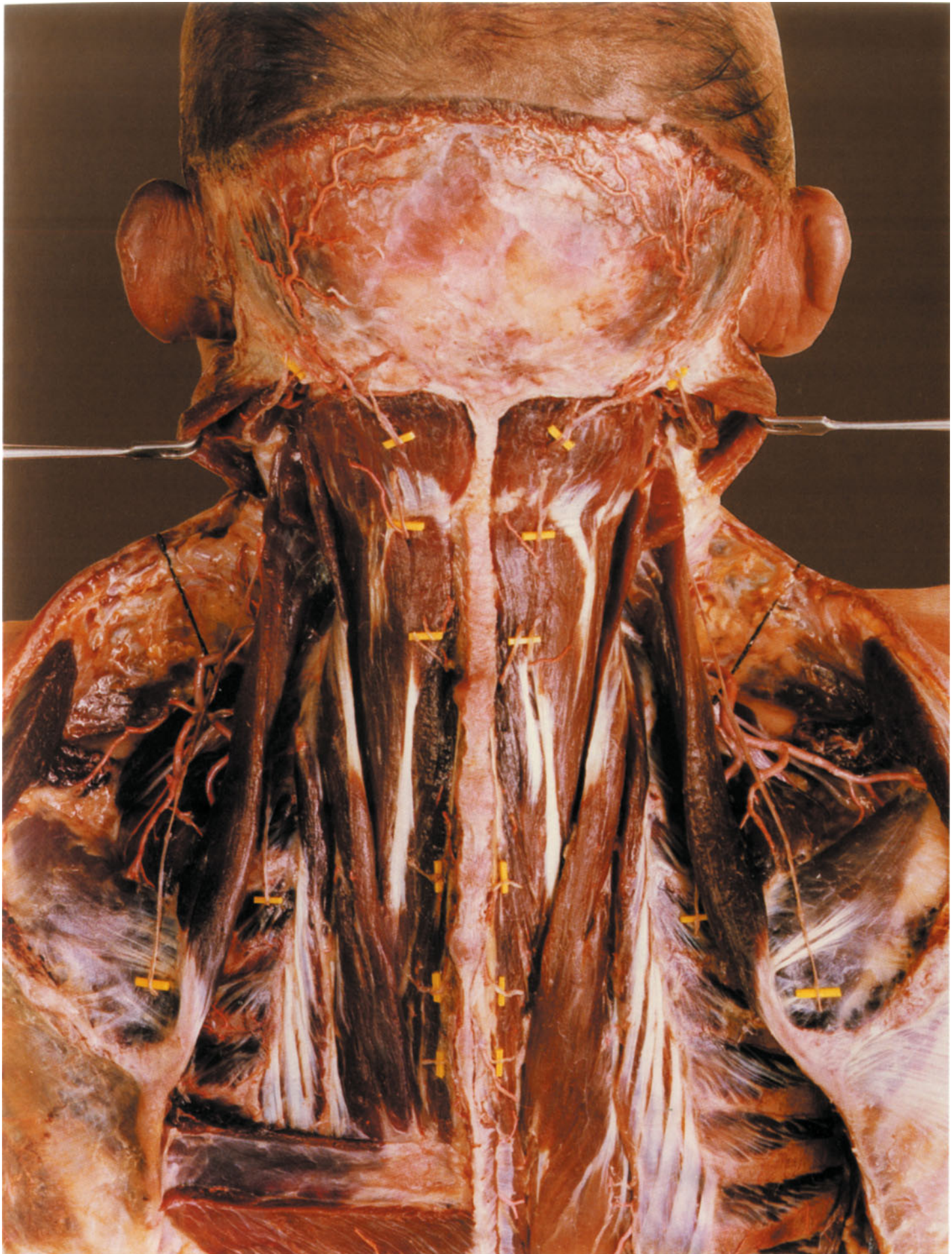
Here the **splenius capitis**, **splenius cervicis**, and **serratus posterior superior** muscles have been resected to expose the **semispinalis capitis** and **longissimus capitis** muscles.

The slender **longissimus capitis** muscle ascends lateral to the **semispinalis capitis** muscle, both muscles having been enclosed from the side by the resected **splenius cervicis** muscle.

The **semispinalis capitis** muscle is pierced by the emerging **dorsal rami** of the second and lower **cervical nerves**. These are **medial branches** (the lateral branches carry only motor fibers) that emerge near the **spinous processes** or, at lower levels, on the processes themselves. They are accompanied by branches of the **deep cervical artery** that are homologous to the posterior branches of the posterior intercostal arteries.

The highest **dorsal ramus** that is distributed to the skin arises from the **second cervical nerve** just past the **lateral atlantoaxial articulation** of the spine. Its thick sensory **posterior branch** loops upward around the **obliquus capitis inferior** muscle, pierces the **semispinalis capitis** and **trapezius** muscles and, as the **greater occipital nerve**, supplies the skin of the scalp as far as the vertex.

The **third occipital nerve** is formed by the **medial branch** of the **dorsal ramus** of the **third cervical nerve**. Past the **intervertebral foramen** it loops backward around the **articular process** of the second and third cervical vertebrae and pierces the musculature while still slightly ascending. From the fifth cervical nerve downward, the **dorsal rami** take an increasingly descending course through the muscles, and the distances between them are greater than the spacing of the corresponding vertebral levels.



In this specimen only part of the **splenius capitis muscle** has been resected after removal of the **trapezius muscle** to demonstrate the course of the **occipital artery**.

The **sternocleidomastoid muscle** has been retracted laterally with the **lesser occipital nerve** to expose more of the insertion of the **splenius capitis muscle**. This muscle, like the **sternocleidomastoid muscle**, is attached laterally to the **mastoid process** and **superior nuchal line**.

The **longissimus capitis muscle** also attaches to the **mastoid process**, passing deep to the **splenius capitis muscle** and occupying a small area near the posterior margin and lower end of the process.

The **occipital artery** shows a variable relation to the upper portions of both muscles. It may run medial to the **longissimus capitis muscle** and become applied at once to the **semispinalis capitis muscle**, as on the right side of this specimen, or it may course between the **longissimus capitis** and **splenius capitis muscles** as on the left side.

The **occipital artery** arose from the **external carotid artery** in the **carotid triangle**, running backward and passing deep to the **sternocleidomastoid muscle** along the lower border of the **posterior belly** of the **digastric muscle**. Between the attachment of the **sternocleidomastoid muscle** on the **mastoid process** and the origin of the posterior belly of the **digastric muscle** in the **mastoid notch**, the artery runs on the petrous part of the temporal bone, following its homonymous **groove** before emerging between the capitis muscles.

In contrast to the previous figure, the **third occipital nerve** pierces the **splenius capitis muscle** and the **greater occipital nerve** has already split into two branches before emerging from the **semispinalis capitis muscle**.



The **splenii muscles** have been completely removed in this specimen to expose the **tendinous intersections** of the **semispinalis capitis** and **longissimus capitis muscles**.

The **tendinous intersections** are not simply a morphologic detail showing that these muscles have multiple bellies; they also provide an excellent **landmark** for identifying the muscles through a limited surgical approach.

The **semispinalis capitis muscle** has two tendinous intersections. The lower of the two is a long, oblique **tendinous intersection** whose center is at the level of the seventh cervical vertebra. It is incorporated into the slips by which the muscle arises from the transverse processes of the upper thoracic vertebrae. A **superficial part** of the **muscle bundles** ascends from the upper end of the intermediate tendon to the **occipital bone**. The **second tendinous intersection** occurs in the medial and deep muscle bundles at the level of the **axis**. It is continued into the **lateral part** of the muscle, defined by an intermuscular interval, where it has a downward extension that may reach to the fourth cervical vertebra.

The upper bellies of both parts of the muscle extend superficially almost to the **insertion** on the medial half of the **superior nuchal line**, while the deeper parts have relatively long tendinous insertions that extend to the **inferior nuchal line**.

The slender **longissimus capitis muscle** on the lateral side of **semispinalis capitis muscle** also has two **tendinous intersections** that lie at about the same level as those of semispinalis muscle. The higher of the two is not always well developed, but the lower is long and bandlike. The **longissimus capitis muscle**, like the **semispinalis capitis muscle**, arises from the transverse processes of the lower cervical and upper thoracic vertebrae and is attached to the **mastoid process**.

With the **ligamentum nuchae** removed, the **spinous processes** and cervical **interspinales muscles** can be seen between the separated medial borders of the **semispinalis capitis muscle**.



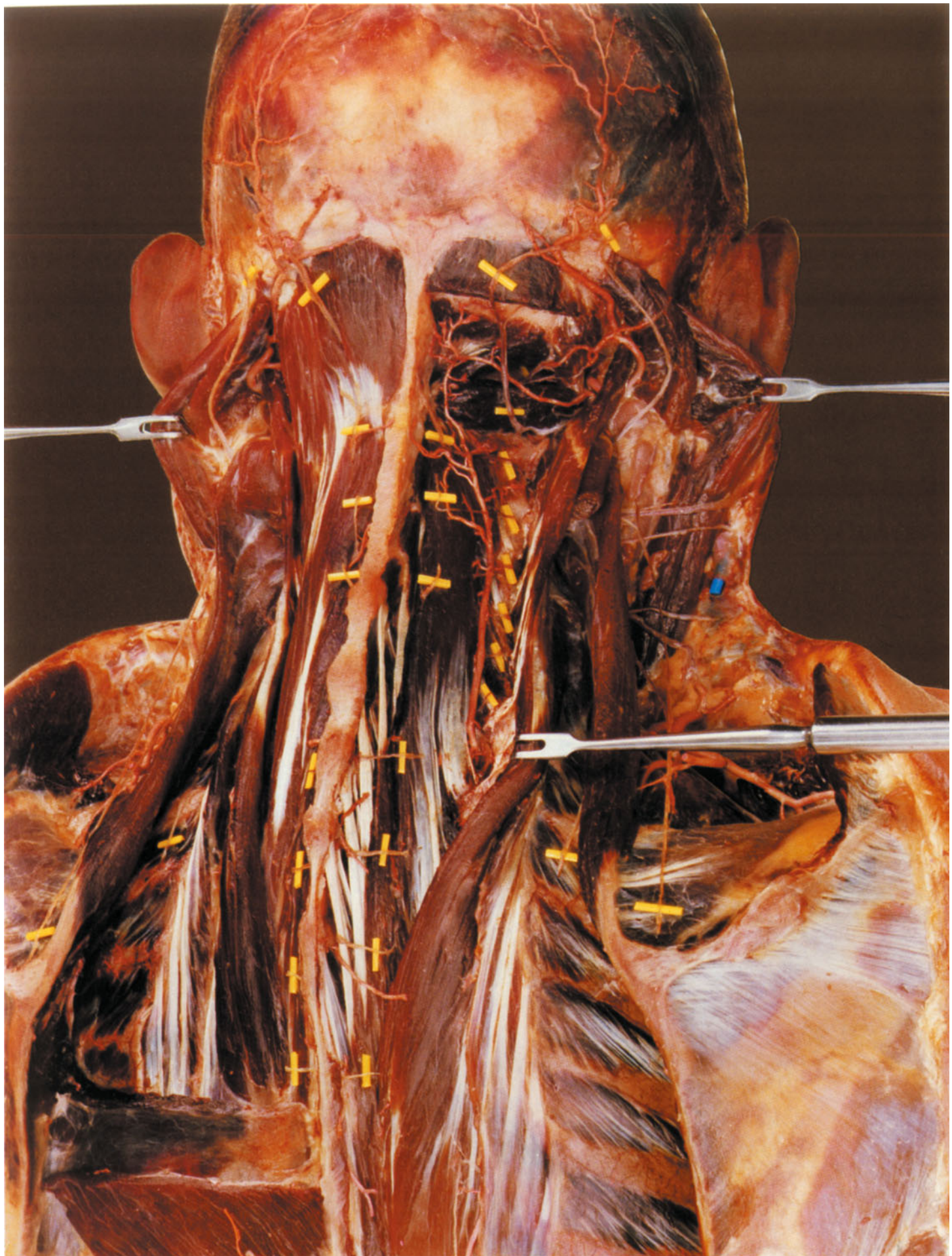
Here the **semispinalis capitis muscle** has been resected on the left side to expose the cervical portion of the **semispinalis cervicis muscle**. This muscle overlies the relatively thin **multifidus muscle**, which covers the vertebral arches.

This dissection also displays the **suboccipital muscle group**, in which the **rectus capitis posterior major muscle** and the **obliquus capitis superior** and **inferior muscles** define the **suboccipital triangle** containing the **vertebral artery** and the **posterior arch** of the **atlas**.

A branch of the **vertebral artery** leaves this **triangle** in front of the tagged **suboccipital nerve** and unites with the deep **descending branch** of the **occipital artery** to form the **occipital anastomosis**. Usually quite large, this anastomosis is important for maintaining cerebral blood flow if the proximal **vertebral artery** or carotid arteries become occluded. The **cervicalis profunda artery** and **ascending cervical artery** also anastomose in this area through a coarse vascular plexus that also connects with the **descending branch** of the **occipital artery**.

The **dorsal rami** of the **cervical nerves** have been doubly tagged: once at their site of entry into the **autochthonous muscles** and again at their site of emergence. Immediately after arising from the spinal nerve, they wind around the articular processes of the cervical vertebrae on the lateral side. Only the **second cervical dorsal ramus** runs straight backward from its spinal nerve origin behind the **lateral atlantoaxial articulation**. After passing around the **obliquus capitis inferior muscle** from below, it pierces the **semispinalis capitis muscle** and ascends to the occiput as the **greater occipital nerve**.

The **cervicalis profunda artery** in this specimen, after arising from the **costocervical trunk**, did not course between the transverse processes of the seventh cervical and first thoracic vertebrae as it does in two-thirds of the population, but instead passed below the transverse process of the **first thoracic vertebra**. Only an accessory connection is present at the typical site. Another variant is the absence of a **posterior cutaneous branch** from C4.



Suboccipital puncture (cisternal puncture) is performed with the head flexed forward. The **needle** is inserted through the skin on the **median plane** above the **spinous process** of the **axis** (epistropheus). It is angled upward and advanced until the tip comes in contact with the **occipital squama**.

Palpation of the **spinous process** of the **axis** is of little help in locating the **puncture site**, because the process itself is not palpable. Its position can be estimated, however, by palpating the **external occipital protuberance**. With the head flexed forward, the spinous process of the axis lies about 7 cm below the external occipital protuberance.

By gently advancing and withdrawing the needle while raising its hub, the operator can work the **puncture site** through the compliant **subcutaneous tissue** to the level of the **posterior arch** of the **atlas**. This motion occurs about a **pivot point** located near the firm posterior margin of the **ligamentum nuchae**, represented here by crossed needles. The posterior margin of the **foramen magnum** of the **occipital bone** is located by noting the sudden loss of needle-bone contact just below it. When the needle is advanced at this site, it will penetrate the **posterior atlanto-occipital membrane** and enter the **cerebellomedullary cistern**.

The **spinal dura mater** above the **posterior arch** of the **atlas** is fused with the **posterior atlanto-occipital membrane** to form a uniform fibrous sheet that directly overlies the **arachnoid membrane**. The **epidural space** is not continued within this sheet, but laterally the space does continue to the **skull base** and contains the last extracranial segment of the **vertebral artery**.

The **rectus capitis posterior minor** and **major muscles** have also been resected to expose the **atlanto-occipital membrane**. Lateral to these muscles in the **suboccipital triangle**, we see the tagged **suboccipital nerve** and the **vertebral artery** in its homonymous groove with the sectioned communicating branch to the **occipital artery**.

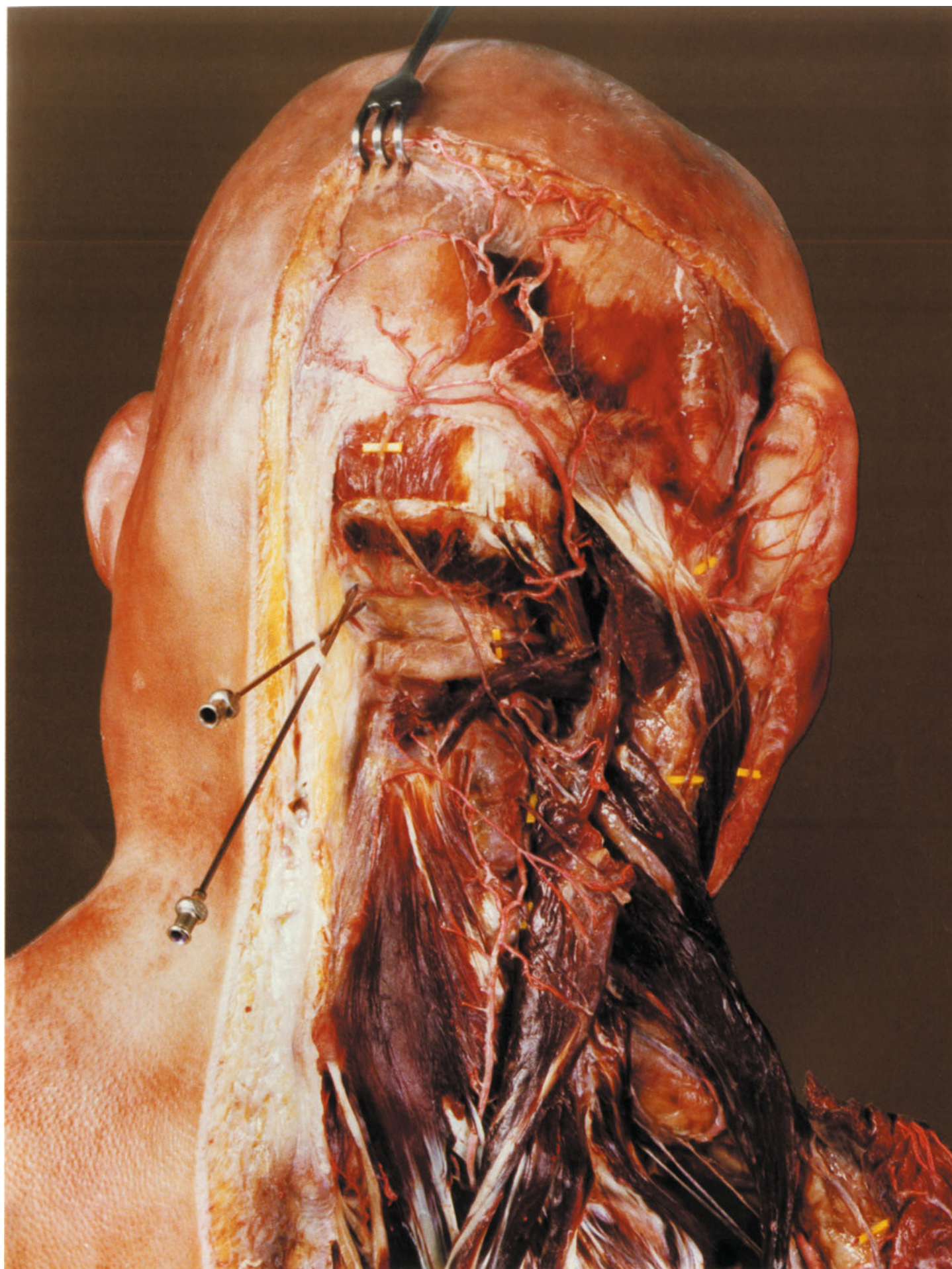


Figure 60**Suboccipital Puncture 2
Occipital Region
and Posterior Cervical Region**

The **bony cranial vault** has been windowed in the right lower quadrant, and the adherent **dura mater** has been removed to expose the intracranial contents down to the **foramen magnum** of the **occipital bone**.

The **occipital pole** of the brain has been retracted upward to demonstrate the upper surface of the **tentorium cerebelli** and its junction with the **falx cerebri**. Partially opened **dural sinuses** are visible at the former attachment of this fold of **dura mater**. The **falx cerebelli** extends downward from the still-intact **confluent sinus**.

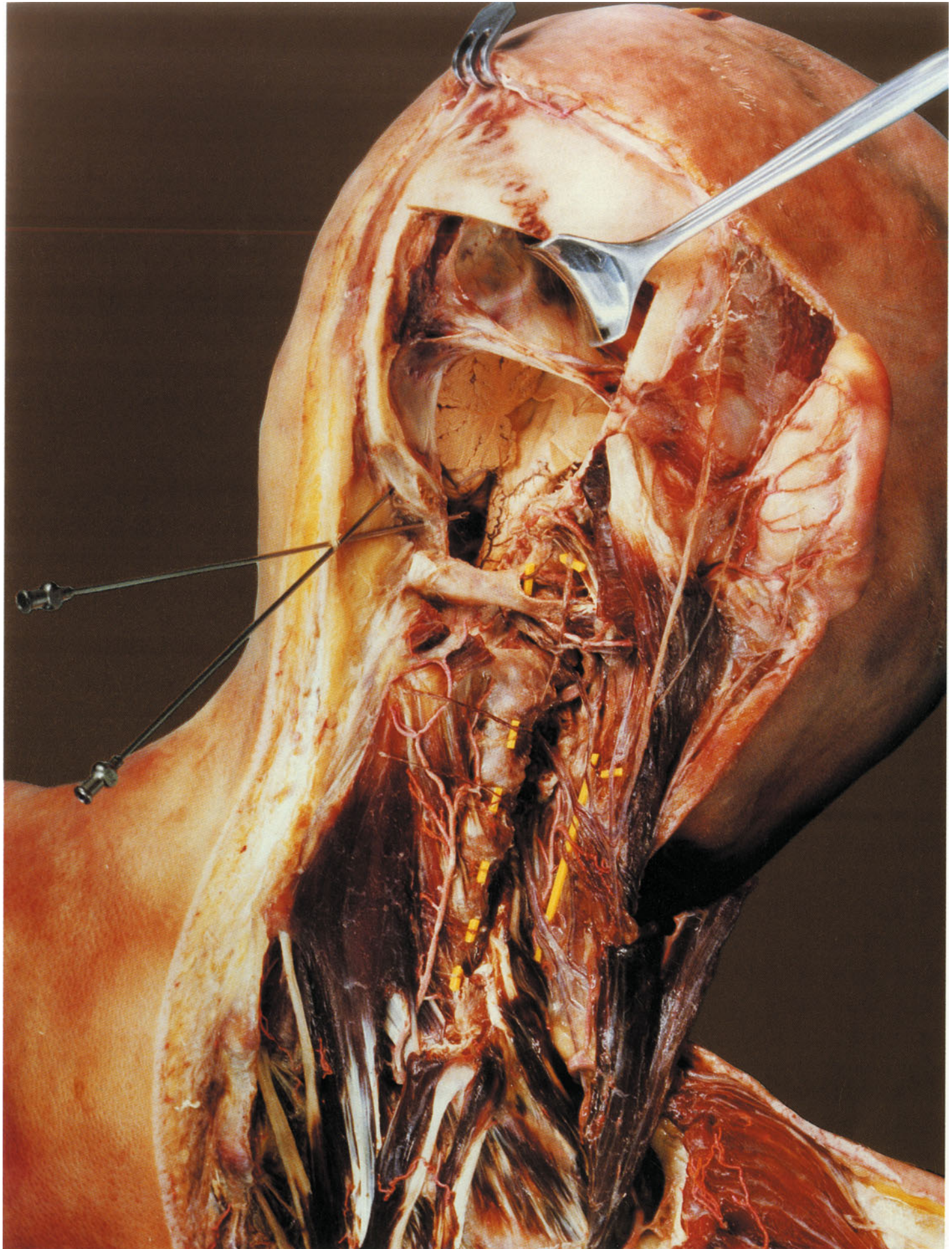
In the **posterior cranial fossa**, the right half of the **cerebellum** has been removed with the **arachnoid** to display the interior of the **fourth ventricle** of the brain.

The inferior part of the **cerebellar vermis** separates from the **tela choroidea** of the fourth ventricle and the **medulla oblongata** earlier than the cerebellar hemispheres, forming an interhemispheric hollow called the **vallecula**. The **arachnoid** follows the **dura mater** and makes the **vallecula** the broadest part of the **cerebellomedullary cistern**.

The puncture needle has been inserted through the **atlanto-occipital membrane**, and its tip is visible in the **cerebellomedullary cistern**. The needle should be advanced no more than 1/2 to 1 cm past the point where the palpable resistance of the membrane is felt.

The **puncture needles** have been crossed as in the previous figure to illustrate the pivot technique. But an experienced operator can insert the needle directly along the definitive path without swiveling it into position. This path lies on a plane passing from the external auditory canals to the upper part of the forehead. The direct technique presumes that the operator can perceive the change in resistance on penetrating the **atlanto-occipital membrane**, which lies about 3 cm from the skin surface.

The **posterior atlanto-occipital membrane**, the **ligamentum flavum** between the arches of the **atlas** and **axis**, has been removed on the right side to expose the **spinal dura mater** and the spinal ganglion of the **second cervical nerve**.



The lower boundary of the anatomic **posterior cervical region**, formed by a line passing from the **seventh cervical spinous process** to the **acromion**, does not correspond to the visual impression of the nuchal boundary. The neck appears much shorter when viewed from behind because its root merges with the shoulder.

The boundary between the **neck** and **shoulder** can be located by drawing a **perpendicular line** through the upper free border of the **trapezius muscle** to the **seventh cervical spinous process**, outlining a **suprascapular region** in the posterior cervical region that extends inferiorly to the **scapular spine**.

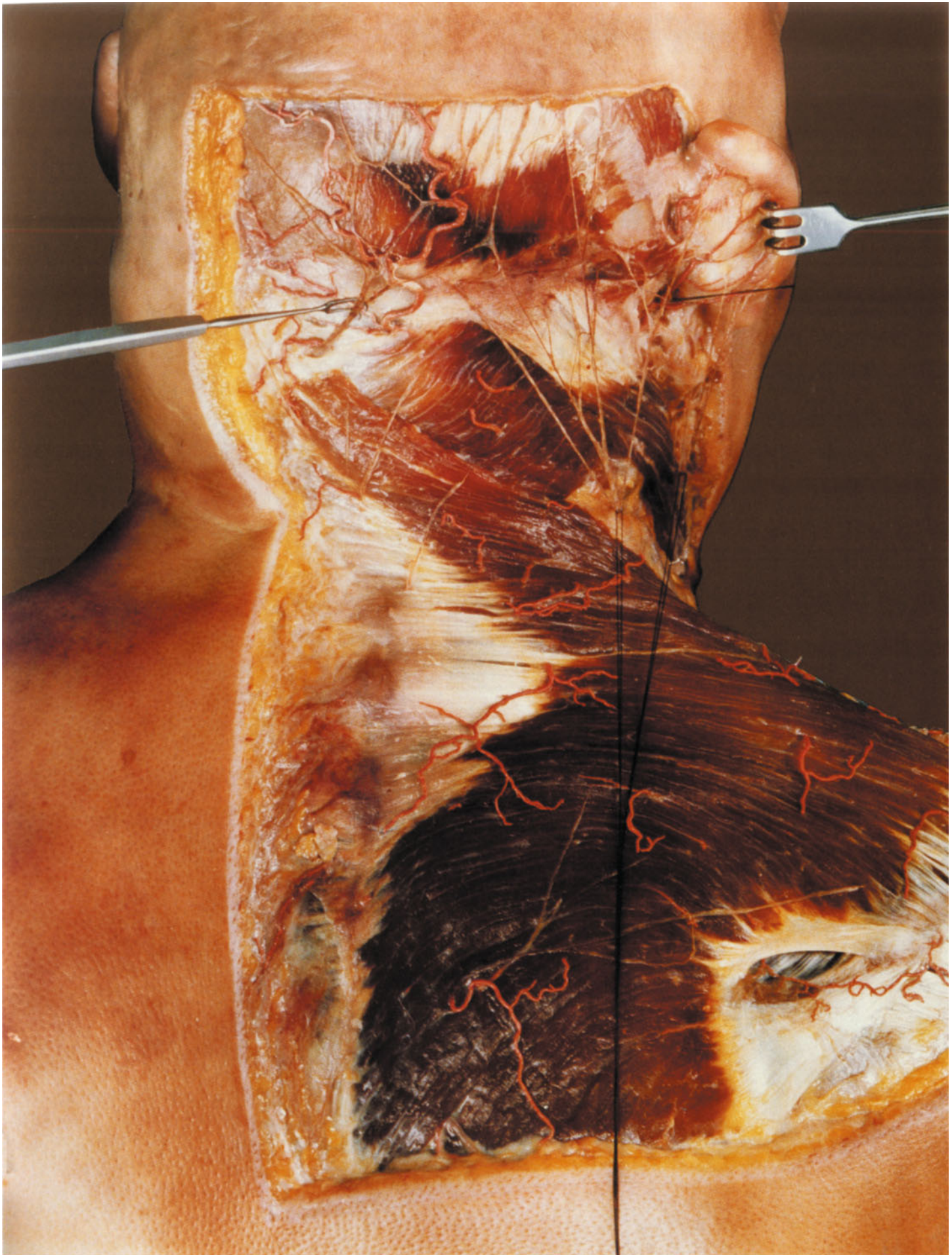
Defining a **suprascapular region** is useful topographically for describing the transition of nerves and blood vessels from the neck to the shoulder. These structures are covered posteriorly by the powerful **transverse part** of the **trapezius muscle**, which arises from the **spinous processes** of the lower two **cervical vertebrae** and **upper three thoracic vertebrae** and inserts from the acromial end of the **clavicle** almost to the medial end of the **scapular spine**. Large cutaneous arteries from the **superficial branch** of the **transverse cervical artery** appear on the surface of the muscle.

The more inferior bundles of the **transverse part** of the **trapezius muscle** pass into an atypical **tendinous arch** that attaches to a rounded prominence on the scapular spine, the **spinous tubercle**. This arrangement creates an interval in which the **supraspinous fascia** with its tendinous attachments from the **ascending part** of the **trapezius muscle** can be seen.

The **descending part** of the **trapezius muscle** arises from the **superior nuchal line** and the **ligamentum nuchae**. It forms the inverted upper free border of the muscle as it passes to its area of insertion on the lateral third of the **clavicle**. The **ascending part** is attached by a triangular tendon to the **scapular spine** near the **spinous tubercle**.

The dissection shows an **anastomosis** between the **greater and lesser occipital nerves** and the manner in which the **auricle** is supplied by the **lesser occipital nerve** and the **posterior branch** of the **great auricular nerve**.

The **sagittal skin incision** carried downward from the **external occipital protuberance** demonstrates the relative thicknesses of the **skin** and **subcutaneous tissue** along the medial plane.



The **descending part** of the **trapezius muscle** and most of its **transverse part** have been resected to expose the second muscular layer of the **supraclavicular region**, consisting of the **levator scapulae** and **rhomboid muscles**.

The **levator scapulae muscle** has been retracted laterally from the **rhomboid muscles**, enlarging the interval between them and exposing the tagged **dorsal scapular nerve** and the **deep branch** of the **transverse cervical artery**. The **chest wall** and **scalenus posterior muscle** are visible above the dorsal scapular nerve.

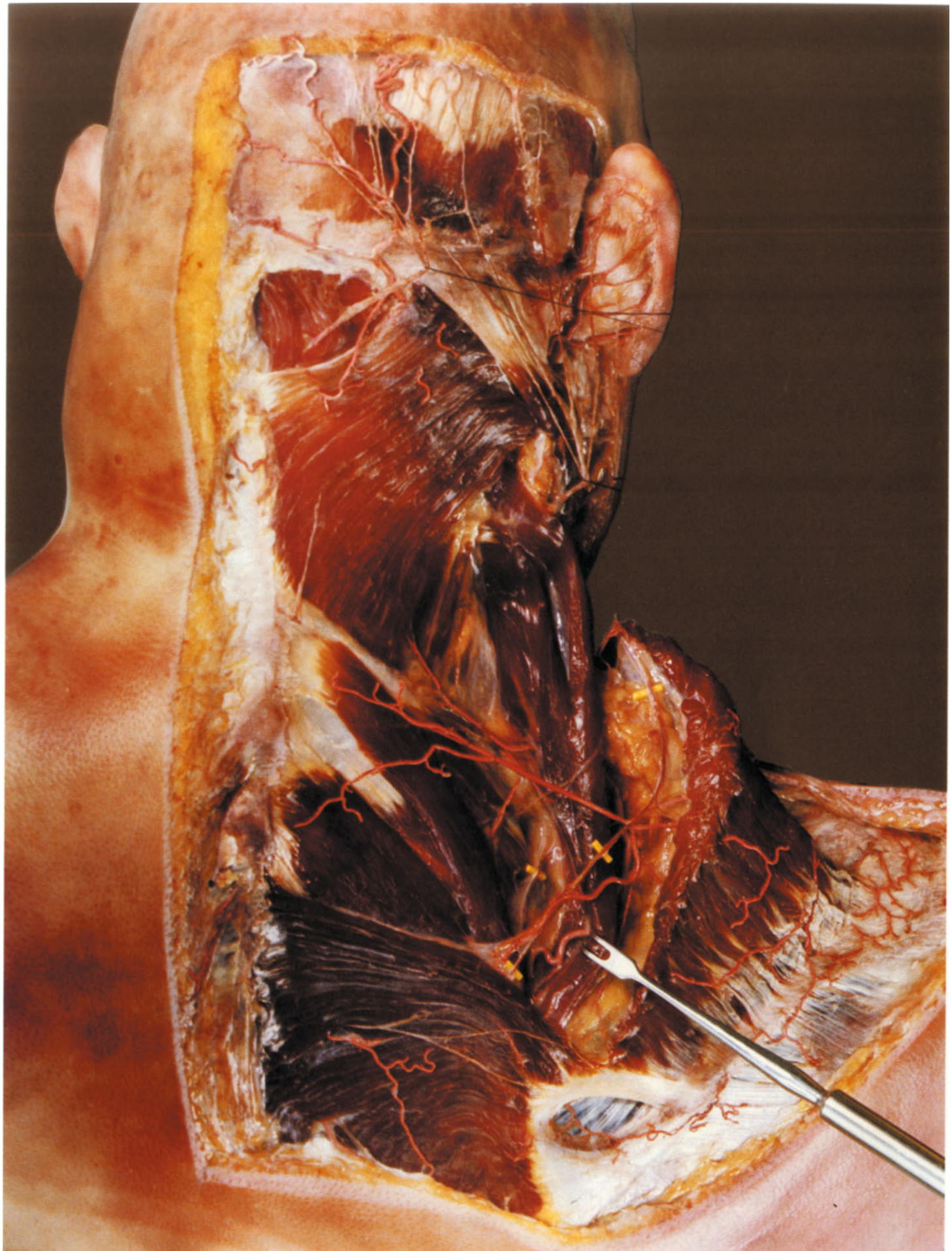
The **levator scapulae muscle** arises by four slips from the **transverse processes** of the first four cervical vertebrae and inserts above the scapular spine on the **medial border** and **superior angle** of the **scapula**. Coursing between it and the **trapezius muscle** are the **accessory nerve** and the **superficial branch** of the **transverse cervical artery** with its **ascending** and **descending branches**.

After leaving the **lateral cervical triangle**, the **accessory nerve** winds around the lateral border of the **levator scapulae muscle** to the **medial border** of the **scapula**, which it follows on the medial side until its branches terminate in the **trapezius muscle**.

The **stump** of the resected **trapezius muscle** has been slightly lateralized to demonstrate its cross section. It can be seen that the muscle is thickest in its **transverse part**. In very muscular individuals, this part of trapezius muscle creates a sloping lateral neck contour with an apparent **shortening of the neck**, especially if the shoulder is slightly raised due to voluntary effort or disease (e.g., barrel chest due to emphysema).

The slightly expanded rhomboid interval separates the **rhomboideus minor muscle** from the **rhomboideus major muscle**, which arise from the **spinous processes** and are attached to the **medial border** of the **scapula**, almost reaching its **inferior angle**.

The **greater** and **lesser occipital nerves** have been elevated with traction threads.



The **rhomboid muscles** have been removed and the **scapula** and **levator scapulae muscle** have been broadly retracted to expose the third muscular layer of the **supraclavicular region**.

The **serratus posterior superior muscle** arises by long, flat tendons from the **spinous processes** of the lower two **cervical vertebrae** and upper two **thoracic vertebrae** and is attached by four fleshy or short tendinous slips to the **second** through **fifth ribs**. Its attachment to the second rib adjoins the tendinous attachment of the **scalenus posterior muscle** and the tendinous expansion of the **scalenus medius muscle**. In its downward and lateral course, the **serratus posterior superior muscle** passes external to the **splenius, longissimus, and iliocostalis muscles**.

Below the last tendon of origin of **levator scapulae**, the **scalenus posterior muscle** arises from the **transverse processes** of the **fifth** and **sixth cervical vertebrae**, flanked posteriorly by **iliocostalis cervicis** and anteriorly by **scalenus medius**.

Between the fleshy attachment of the **scalenus medius muscle** to the upper surface of the **first rib** and its expansion to the **second rib** lies a slightly widened interval in which the border of the **first rib**, showing reddish discoloration, can be seen.

The **dorsal scapular nerve** and **long thoracic nerve** emerge from the **scalenus medius muscle**. Having been retracted laterally with the **levator scapulae muscle**, the **dorsal scapular nerve** reappears below at the level of the **superior angle** of the **scapula** along with the **deep branch** of the **transverse cervical artery**. This deep branch is also called the **dorsal scapular artery** because it courses in the same plane as the **dorsal scapular nerve**. Both are covered from behind by the **rhomboid muscles** and descend medial to the **medial border** of the **scapula**.

The **accessory nerve**, tagged superiorly at the entrance to the **lateral cervical triangle**, descends lateral to the **levator scapulae muscle** to the deep surface of the **trapezius muscle** and is accompanied by the **superficial branch** of the **transverse cervical artery**.



The anatomic nomenclature lacks a specific and unique term for the **back**. The **dorsum** is often interpreted to mean the posterior body region between the **external occipital protuberance** and the **apex** of the **sacrum**. But “back” does not denote the back of the neck or the lumbar region and refers only to the **posterior region** of the **thorax**. We therefore use the term **dorsum of the thorax** in describing this region.

The **dorsum of the thorax** can be subdivided into the **scapular region**, **interscapular region**, and **infrascapular region**. The medial part of the **interscapular region** is posterior to the spinal column, which describes a separate region, the **vertebral region**, extending from the seventh cervical vertebra to the sacrum. Thus, the interscapular region includes the **thoracic vertebral region**, and the **lumbar vertebral region** is flanked by the **lumbar region**.

The **suprascapular region** is a **transitional region** between the neck and back. It includes the lower part of the **posterior cervical region** as defined in Fig. 61 and the upper part of the **scapular region** as far as the **scapular spine**.

The **figure** shows the posterolateral aspect of the back with the shoulder moved forward and the arm abducted. This position opens up the **triangle** between the **medial border** of the **scapula** and the two borders of the **trapezius** and **latissimus dorsi** muscles. This triangle contains much of the **rhomboideus major muscle**, and lateral to the **iliocostalis thoracis** we see the **seventh** and **eighth ribs** with the fascia-covered **intercostal muscles**.

The **infraspinous fascia** has been windowed to show the boundary between the **teres minor** and **infraspinatus** muscles. A cutaneous branch of the **circumflex scapular artery** leaves the **triangular space** of the axilla between the **teres major** and **teres minor** muscles.

The **posterior cutaneous branches** emerge from the **trapezius muscle** in the midthoracic region in **two rows**, which are not bilaterally symmetrical. Only the **lateral row** is continued into the lower thoracic region. When the scapula occupies a normal position, the boundary between the **posterior cutaneous branches** and the **lateral cutaneous branches** of the **intercostal nerves** lies on a medially convex line extending from the **inferior angle** of the **scapula** to the **midpoint** of the **iliac crest**.



This view from above demonstrates the **curvature** of the **thoracic spine**, which can be increased only slightly by active effort. The physiologic **kyphosis** of the thoracic spine is variable in the adult population. It tends to increase with aging and may cause **humpback** deformity in pathologic cases.

A large window has been cut in the **trapezius muscle** to demonstrate the **second muscular layer** of the **suprascapular region** and **interscapular region**. This layer, consisting of the **levator scapulae** and **rhomboid muscles**, has special significance in the distribution of nerves and blood vessels.

The **accessory nerve** passes behind the **levator scapulae muscle** to enter the plane between the **trapezius** and **rhomboid muscles**. The **dorsal scapular nerve**, which lies on the next deeper plane, runs medial to **levator scapulae** to the anterior surface of the **rhomboid muscles**, posterior to the **serratus posterior superior muscle**.

The **transverse cervical artery** divides into a **superficial branch** and a **deep branch**.

The **deep branch** courses in the plane of the **dorsal scapular nerve**. When it arises separately from the **subclavian artery**, it passes through the **brachial plexus** and is called the **dorsal scapular artery**. It passes to the anterior side of the **rhomboid muscles**, either by gaining this plane at once and passing medially in front of **levator scapulae** or by circling around the posterior aspect of the attachment of **levator scapulae**. It then descends, passing very close to the **medial border** of the **scapula**, and distributes branches to the **rhomboids muscles**, the **scapular muscles**, and **latissimus dorsi**. There it also anastomoses with dorsal branches of the **posterior intercostal arteries**, which may largely replace it.

The **superficial branch** is on the plane of the **accessory nerve** and divides into **ascending** and **descending branches**.



This dissection shows the **quadrangular space** and **triangular space** of the axilla from the posterior aspect with the shoulder in maximum abduction. The posterior border of the **deltoid muscle** has been elevated with a hook to expose the **quadrangular space** of the axilla. The **long head** of the **triceps brachii muscle** has been retracted downward to open up the space.

The interval between the **teres major** and **teres minor muscles** in the axilla is subdivided into the **quadrangular space** and **triangular space** by the **long head** of the **triceps brachii muscle**, which descends behind **teres major** and in front of **teres minor**.

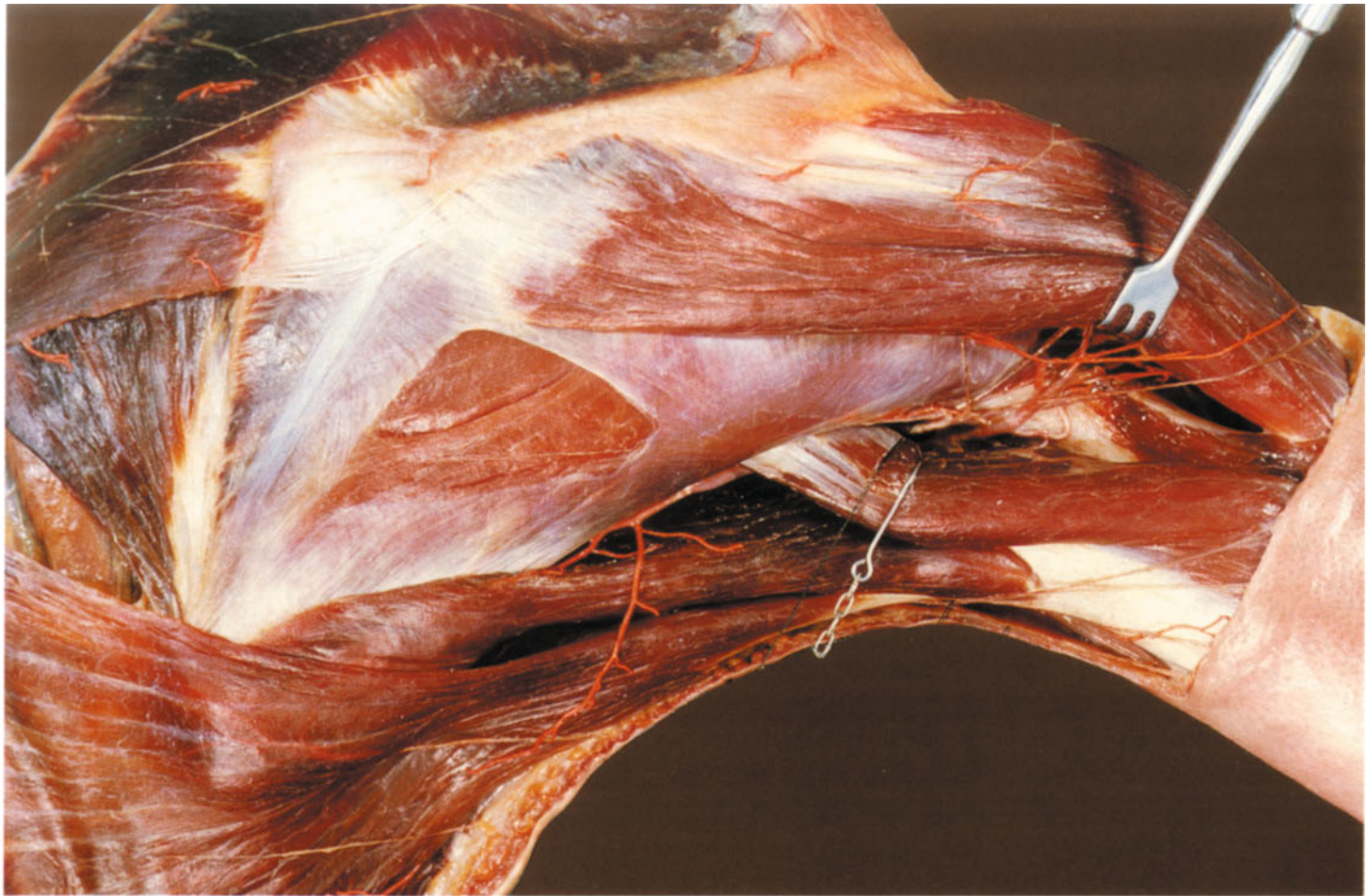
The **quadrangular space** is bounded laterally by the **surgical neck** of the **humerus**. This space transmits the **axillary nerve** and the **posterior circumflex humeral artery**, which in the abducted arm wind around the humeral neck as they ascend to the **deltoid muscle**, to which they are chiefly distributed.

Thus, the nerve and artery divide very early into multiple branches. At the initial branch point of the **axillary nerve**, the posterior enlarged part of the nerve (pseudo-ganglion) gives off the **superior lateral cutaneous nerve of the arm**, a **muscular branch** with a perforating cutaneous branch, and the **nerve of the teres minor muscle**. The **superior lateral cutaneous nerve of the arm** passes around the posterior border of the **deltoid muscle** to supply the skin over the distal part of the muscle and the proximal upper arm.

On the posterior side the **posterior cutaneous nerve of the arm** arises in the axilla from the **radial nerve**, which has split into two branches, the lower of which is distributed to the elbow.

The two nerve branches visible on the axillary fold are posterior twigs from the **lateral cutaneous branches** of the **third and fourth thoracic nerves**.

The medial **triangular space** of the axilla transmits the **circumflex scapular artery**, which passes into the **infraspinous fossa** to supply the muscles in that area after first giving off a branch to the **teres muscles** and the **skin**.



A



B

This dissection gives a posterior view of the **normally positioned shoulder** that is easily correlated with standard anatomic depictions of the skeleton.

A large part of **trapezius muscle** has been removed, leaving its inferior border and most of the tendinous attachment of its ascending part (reflected laterally) on the **spinous tubercle**. The muscles of the **second layer**, consisting of **levator scapulae** above and the two **rhomboid muscles** below, insert along the **scapula** from its **superior to inferior angle**.

The interval between the **rhomboideus minor** and **rhomboideus major muscles** has been widened somewhat to display the tagged **dorsal scapular nerve**. It is accompanied by the snared **deep branch** of the **transverse cervical artery**, which arises at the anterior border of the **levator scapulae muscle**.

The **transverse cervical artery** is crossed by the tagged **accessory nerve** and anastomoses with a resected **deep branch** [suprascapular branch] which replaces the **descending branch** posterior to the **rhomboid muscles**. This somewhat violates the normal arrangement in which the **superficial branch** lies in the plane of the **accessory nerve**, but it is not too surprising when we consider the exceptional **variability** of this vessel. A truly unusual feature is the delayed origin of the superficial branch, which consists of only one ascending branch.

Tags have been placed to mark the **posterior cutaneous nerves**, which emerge in two rows as the **medial and lateral posterior cutaneous nerves**.



Figure 68**Dorsum of the Thorax 4
Suprascapular Region 6
Interscapular Region 2**

Here the **rhomboid muscles** have been divided and retracted to expose the deepest layer of the **interscapular region**. This layer includes the tendinous attachments of the **iliocostalis thoracis muscle**, which arises from the lower ribs and is inserted into the **angles** of the upper ribs.

The **iliocostalis muscle** in the upper part of the field runs deep to **serratus posterior superior muscle**, whose lowest slip is attached to the fifth rib. The **intercostales muscles**, covered by the **external thoracic fascia**, are visible in the angle below the margins of the iliocostalis and serratus posterior superior muscles.

The **superficial layer** of the **thoracolumbar fascia**, which covers the **erector spinae muscle** and becomes aponeurotic in its inferior portion, gradually thins below the **trapezius muscle**, and the **tendons** of the **iliocostalis muscle** can be seen through it. The fascia thins abruptly at the lower border of the **rhomboideus major muscle**, however, indicating that the **rhomboid muscles**, like **serratus posterior superior**, are ensheathed by the **thoracolumbar fascia**.

The tagged **dorsal scapular nerve** courses between the **thoracolumbar fascia** and **rhomboid muscles**, and medial to it, at the everted border of the rhomboid muscles, the **posterior branch** of the **transverse cervical artery** descends along the **medial border** of the **scapula** and distributes several **muscular branches** laterally to the scapular muscles. One branch that passes medially establishes typical anastomotic connections with the posterior portions of the **posterior intercostal arteries**.

A branch of the **cervical plexus** that anastomoses with the **accessory nerve** is tagged in the **suprascapular region**.



The course of the **posterior cutaneous branches** of the **thoracic nerves** is important in understanding the arrangement of the **dermatomes**, for it explains the discrepancy, at times considerable, between the levels of the spinal segments and the innervated skin areas.

In this dissection the **posterior cutaneous branches** of all the thoracic nerves have been tagged at the sites where they enter the **subcutaneous tissue**. It has been shown that the areas supplied by the cutaneous nerves are distributed fairly evenly on both sides and that the subcutaneous course of the nerves correlates with the location of the **dermatomes**.

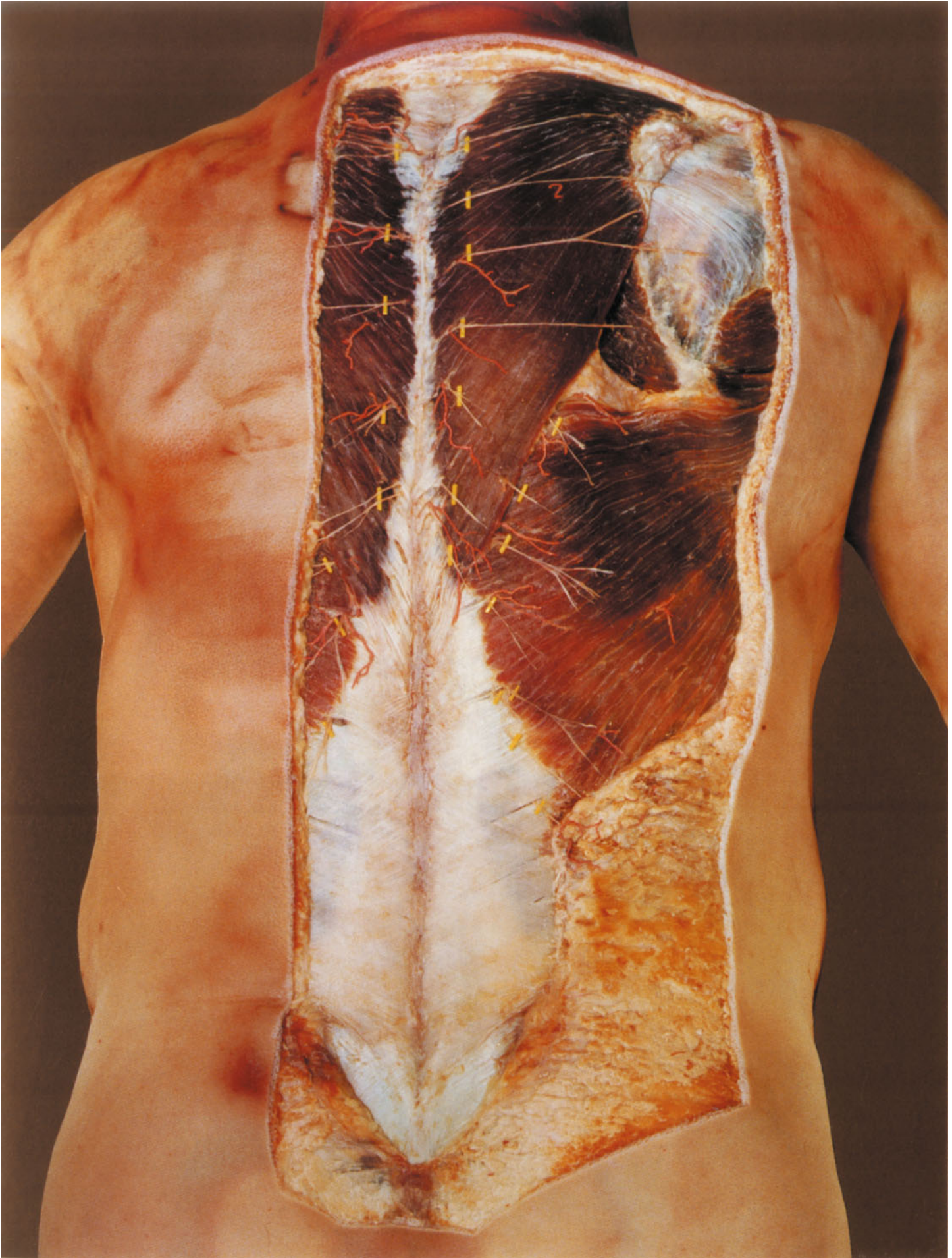
The **dorsal rami** of the **thoracic nerves** each divide into a **medial** and a **lateral branch**. In the **upper half** of the **thorax**, the medial branches carry the sensory fibers for the skin; in the **lower half of the thorax**, the lateral branches carry most of the sensory fibers. The transition is gradual and variable, but two lines of emergence are always formed.

In the **medial row**, the **medial posterior cutaneous nerves** emerge close to the spinous processes of the vertebrae. In the **lateral row**, the **lateral posterior cutaneous nerves** emerge along the lateral border of the **trapezius muscle** and at the junction of the fleshy and tendinous parts of the **latissimus dorsi muscle**.

Both sets of branches take a downward course. The higher **medial posterior cutaneous branches** descend at a sharp angle that becomes less steep inferiorly but still equals almost the height of one intercostal space. The downward course of the **lateral posterior cutaneous branches** is illustrated and discussed in Fig. 70.

The inferior border of the **trapezius muscle** and its origin, which commences at the twelfth thoracic vertebra, provide a useful landmark for locating the sites of emergence of the dorsal cutaneous nerves.

The upper margin of the skin incision lies just cranial to the **spinous process** of the **first thoracic vertebra**, and the first **tagged medial posterior cutaneous branch** emerges at the upper edge of the **spinous process** of the **third thoracic vertebra**. It arises from the **dorsal ramus** of the **first thoracic nerve**.



The **ventral trunk muscles** that migrated backward during phylogenic development have been removed along with the superficial layer of the **thoracolumbar fascia**, exposing the **erector spinae muscle**.

The components of the **erector spinae muscle** – the **iliocostalis**, **longissimus**, and **spinalis muscles** – arise inferiorly by a **broad tendinous mass** extending from the **median sacral crest** to the **iliac crest**. Lateral to the upward extension of this tendon, the muscle mass splits into the **iliocostalis muscle** and the **longissimus muscle**. From the interval between these muscles, the **lateral posterior cutaneous nerves** emerge as a continuation of the lateral branches of the **dorsal rami** of the **thoracic nerves**. Only the lowest of these branches pierce the **iliocostalis muscle**.

After leaving the **erector spinae muscle**, the **lateral posterior cutaneous nerves** run downward for a variable distance, passing beneath the **thoracolumbar fascia** before they pierce it and then take a more lateral course toward the **subcutaneous tissue**. The angulation of the nerves and vessels at the pinheads indicates the sites where they pierce the fascia.

The length of the descending subfascial segment diminishes from above downwards. It equals more than two intercostal spaces in the highest nerve, which arises from the **dorsal ramus** of the **sixth thoracic nerve**.

The discrepancy in the degree of descent of the lateral and medial branches imparts an inverted V-shape to the posterior thoracic **dermatomes** that, as HEAD has observed, is most pronounced around the eighth thoracic segment. Also, the **lateral posterior cutaneous branches** are usually less in number.



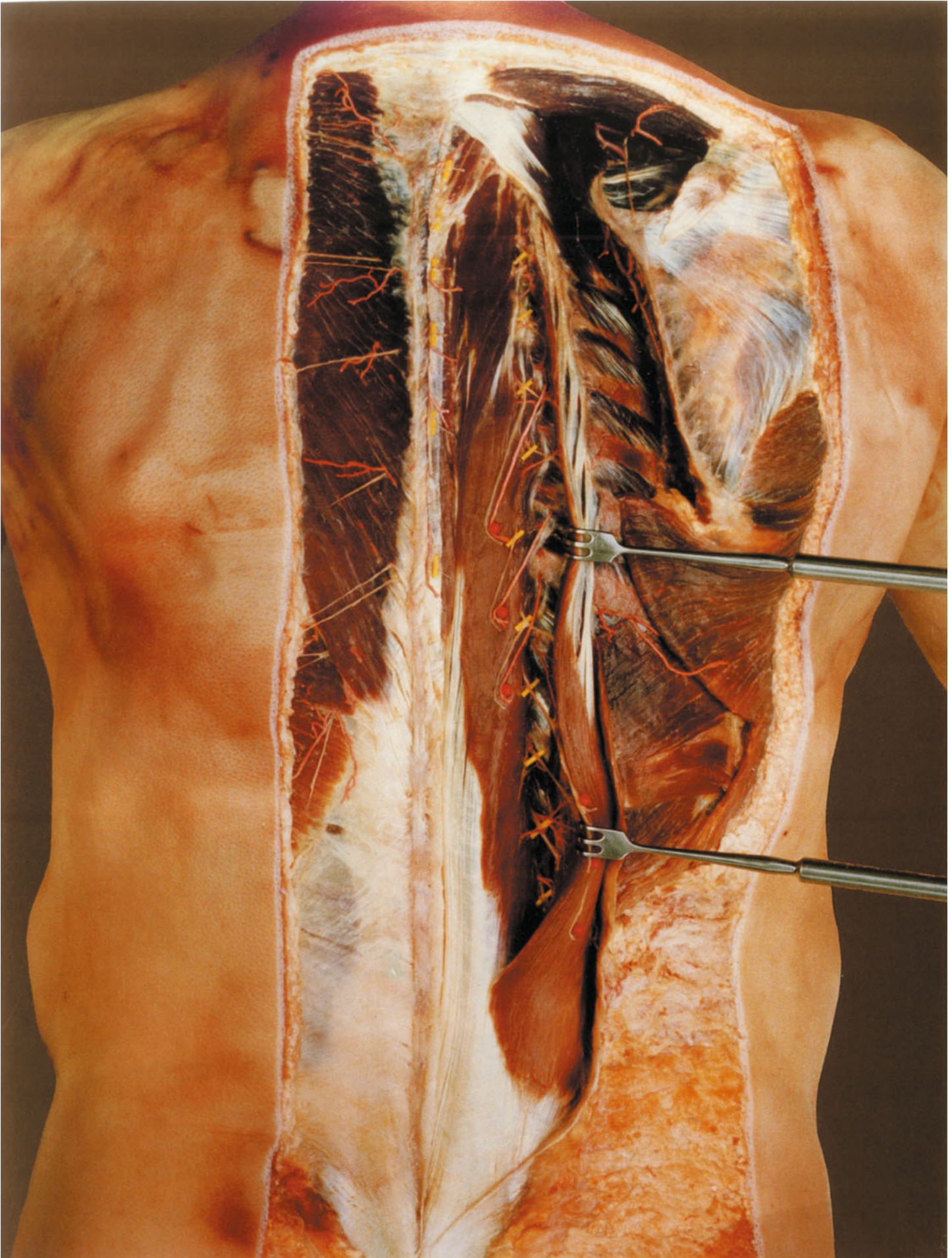
The **interval** between the **iliocostalis muscle** and **longissimus muscle** has been widened compared with the previous figure, and the **iliocostalis muscle**, which inserts on the **costal angles**, has been retracted laterally to demonstrate the tendinous attachments of the **longissimus muscle** to the ends of the transverse processes and the laterally adjacent rib segments.

Between these attachments of the **longissimus** or adjacent muscles, the **lateral branches** of the **dorsal rami** or their more distal motor and sensory divisions enter the interval between the **longissimus muscle** and **iliocostalis muscle**. The sensory **lateral posterior cutaneous branches** are soon accompanied by arteries, each having arisen one segment lower from the **posterior intercostal arteries** and taking the course described in the previous figure.

Viewed closely, this dissection shows that the lateral branch of the **dorsal ramus** of the **seventh thoracic nerve** does not give off a main branch and terminates in the musculature. The branch originally present between the **lateral posterior cutaneous nerves** from T6 and T8 was a displaced **medial posterior cutaneous nerve** and therefore is not present in this figure.

Another atypical feature is that the **lateral posterior cutaneous nerve** from T10 emerges at two separate sites spaced about one segment apart. But this nerve has not assumed the function of the next lower segment, because the next lower cutaneous branch arises from the **eleventh thoracic nerve**. This demonstrates that schematic representations do not always conform to reality.

The medial and lateral branches of the **dorsal rami** of the **thoracic nerves** have a mixed modality, but generally the **lateral branches** carry the **sensory fibers** for the **lower half** of the thoracic nerves while the **medial branches** carry the sensory fibers for the **upper half**.



The common **tendon of origin** of the **iliocostalis muscle** and **longissimus muscle** extending from the **iliac crest** to the **spinous processes** of the **lumbar vertebrae** has been incised and reflected with the underlying muscles.

The muscle mass is well differentiated, but the origin of the **longissimus muscle** is shifted far laterally on the **iliac crest** anterior to the origin of the **iliocostalis**, so part of the muscle had to be divided to gain access to the **costal processes** of the lumbar vertebrae.

The **iliocostalis muscle**, whose tendons are attached to the **costal angles**, has been retracted laterally. The **longissimus** has been dissected back medially somewhat, exposing several insertions of the **levator costarum muscles**.

The lateral branches of the **dorsal rami** of the three highest **lumbar nerves**, tagged in the lower part of the dissected interval, give rise to the tagged **superior clunial branches** that supply the skin of the **gluteal region**. The medial branches of these dorsal rami supply only the musculature.

The **lateral posterior cutaneous branches** give off medial twigs that have been resected in this specimen. The twigs from the lower thoracic nerves supply the skin below the back down to the fourth lumbar vertebra, since the **medial posterior branches** from these segments terminate in the muscles. According to HEAD, only the highest of the **lateral posterior cutaneous branches** from the **fourth thoracic nerve**, here reflected laterally, still supply the segment directly above the **spinous process** of the **twelfth thoracic vertebra**.

The **lateral posterior cutaneous branches** that emerge cranial to the ninth cutaneous branch have been reflected medially to represent the temporary medial course of their initial segments after emerging from the **erector spinae muscle**.

The **posterior branches** of the **lumbar arteries** form large **longitudinal anastomoses** and predominantly supply the muscles. This vascular chain, which commences in the lower thoracic region, gives off several **lateral cutaneous branches** along the nerves.



All of the **erector spinae muscle** has been removed posterior to the **transverse processes** and **vertebral arches** of the thoracic vertebrae on the right side.

The **levator costarum muscles** arise from the ends of the backswept **transverse processes** and close the gap between the **intercostales externi muscles** and the spine. In the third segment from the top, a **levator costae brevis muscle** has been resected to expose the posteromedial border of the **intercostalis externus muscle**. In the next two lower segments, part of the **intercostalis externus muscle** has also been removed after retraction of the **iliocostalis muscle** to better demonstrate the **internal intercostal membrane** and the vessels that traverse it.

The **internal intercostal membrane** is bordered medially by the **superior costotransverse ligament**, which is interposed between the **dorsal** and **ventral rami** of the **thoracic nerve**. Exposure of the ligament has been improved by removing the **intertransverse ligaments** and **intertransverse muscles** in two segments.

At each level the **dorsal ramus** of the corresponding **thoracic nerve** emerges from the **opening** between the superior costotransverse ligament and the root of the transverse process. After passing backward a short distance, it divides into a lateral and a medial branch.

The **lateral branch** is largely a continuation of the dorsal ramus, while the medial branch turns posteriorly and enters the musculature between the **intertransverse ligament** and the **intertransverse muscle** (if present).

The **medial branches** run between the **multifidus** and the **semispinalis muscle**, which is deep to **longissimus** and **spinalis**, passing in a medially convex arc to a point near the **spinous processes**. After piercing the autochthonous muscles and supplying them with **motor fibers**, the branches that carry **sensory fibers** pierce the origins of the **rhomboid muscles** and **trapezius muscle** and enter the **subcutaneous tissue** as **medial posterior cutaneous branches** that are distributed to the skin. **Posterior branches** of the **posterior intercostal arteries** accompany the nerves.



The **internal intercostal membrane** lies on the deep surface of the **intercostalis externus muscle** and extends from the posterior border of the **intercostalis internus muscle** to the **superior costotransverse ligament**.

The **superior costotransverse ligament** stretches from the **neck** of the **rib** to the lower part of the **transverse process** above it, forming an interval called the **costotransverse foramen**.

The **thoracic nerve** usually splits into two rami while still in front of the **costotransverse foramen** and within the **intervertebral foramen**. The **dorsal ramus** turns backward behind the **superior costotransverse ligament** while the **ventral ramus** runs in front of this ligament and enters the intercostal space as the **intercostal nerve**.

The **superior costotransverse ligament** and **internal intercostal membrane** have been removed to demonstrate the **intercostal nerve** in one segment. It is accompanied by the intercostal vessels and quickly gives off branches to the intercostal muscles. The **intercostal nerve** enters the plane between the **intercostales internus** and **intimus muscles** somewhat before the intercostal artery enters the same plane. Before the nerves and vessels enter the muscles, only the thin **endothoracic fascia** separates them from the **parietal pleura**.

The **dorsal rami** have been reflected medially at the sites where the **intertransverse ligaments** were removed. In the lower part of the figure, however, the **lateral branch** of a **dorsal ramus** has been tagged and left in situ. In crossing the **lateral costotransverse ligament**, the lateral branch moves to the adjacent segment. When it reaches the new segment, it is consistently joined by a separate artery that accompanies it to the skin and therefore is called the **lateral posterior cutaneous artery**. Another separate **muscular branch** of the intercostal artery also pierces the **internal intercostal membrane**.

Exposure of the **internal intercostal membrane** was described in the previous figure.



While the **internal intercostal membrane** and the **superior costotransverse ligament** are interposed like a breakwater between the **ventral** and **dorsal rami** of the spinal nerves in the thoracic region, this function is served in the lumbar region by a thin muscular wedge consisting of the lumbar **intertransversarii laterales muscles** and the posterior portion of the **psoas major muscle**.

The **costal processes** are rudimentary ribs that provide attachment for both muscles. All of the **erector spinae** had to be removed in order to demonstrate this layer. On the right side, this has exposed the posterior aspect of the **sacrum** and **vertebral column** with the projecting **costal processes**.

The ends of the costal processes give attachment to the deep layer of the **thoracolumbar fascia**, also called the **lumbar aponeurosis** because it serves as an origin for the **internal oblique** and **transversus abdominis muscles**. The **psoas major** and **quadratus lumborum muscles** are visible through this fascial sheet when not obscured by the thickened fiber tract of the **lumbocostal ligament**.

Tags have been placed beneath the branches of the **dorsal rami** of the **lumbar** and **sacral nerves**. The lateral branches run lateral and the medial branches medial to the **lumbar intertransversarii mediales muscles**, which are attached to the **mamillary process** and **accessory process** of the lumbar vertebrae.

The **interspinal** and **supraspinal ligaments** and the **ligamenta flava** have been removed between the third and fourth lumbar vertebrae, exposing a bony aperture that is relatively high but not very broad. Its width is limited by the **zygapophyseal articulation (intervertebral articulation)** between the articular processes of the lumbar vertebrae. The proximity of this articulation to the **spinous process** results in a surprisingly short vertebral arch.

The **epidural space** has also been cleared to demonstrate the **spinal dura mater**. The position of the needle above the fourth lumbar vertebra indicates the typical site for a lumbar puncture.



Pins have been placed marking the highest points of the **iliac crests** and the **spinous process** of the fourth lumbar vertebra, which lie on a horizontal line, and the **posterior superior iliac spines**. The **erector spinae muscles** have been dissected from the vertebral column and retracted laterally. The sagittal midline incision used to open the **spinal canal** passes through the **spinous processes** and the **supra- and interspinal ligaments**.

With the spinal canal opened, the right half of the **spinal dura mater** has been removed to display the **conus medullaris** and the **cauda equina**, which are visible through the **spinal arachnoid**.

The needle has been positioned at a typical site for performing a **lumbar puncture**. When the spinal canal is intact, the needle penetrates the skin, subcutaneous tissue, and the firm **supraspinal ligament** before piercing the **interspinal ligament**. This ligament offers little resistance to penetration, especially on the midline, owing to the sagittal alignment of its lamellar structure. Near the bone, however, it has a firm, almost fibrocartilage-like consistency.

The **ligamenta flava** leave a 2- to 3-mm-wide gap in the lumbar midline, so the needle should not pierce them when properly inserted. If the needle strays, however, these ligaments will offer significant resistance, as they may reach a thickness of 3 mm.

After piercing these structures, the needle tip enters the **epidural space**, which is filled with loose fatty tissue and the **internal vertebral venous plexus**. The momentary loss of resistance on entry into this space is followed by a perceptible resistance as the needle simultaneously penetrates the **spinal dura mater** and the **spinal arachnoid**.

The **conus medullaris** in this specimen extends to the upper border of the second lumbar vertebra – a normal position in adults. Hence there is no reason why lumbar puncture in an adult could not be performed one level higher, especially since the marked forward flexion of the spine generally used for lumbar punctures tends to cause slight upward retraction of the conus.

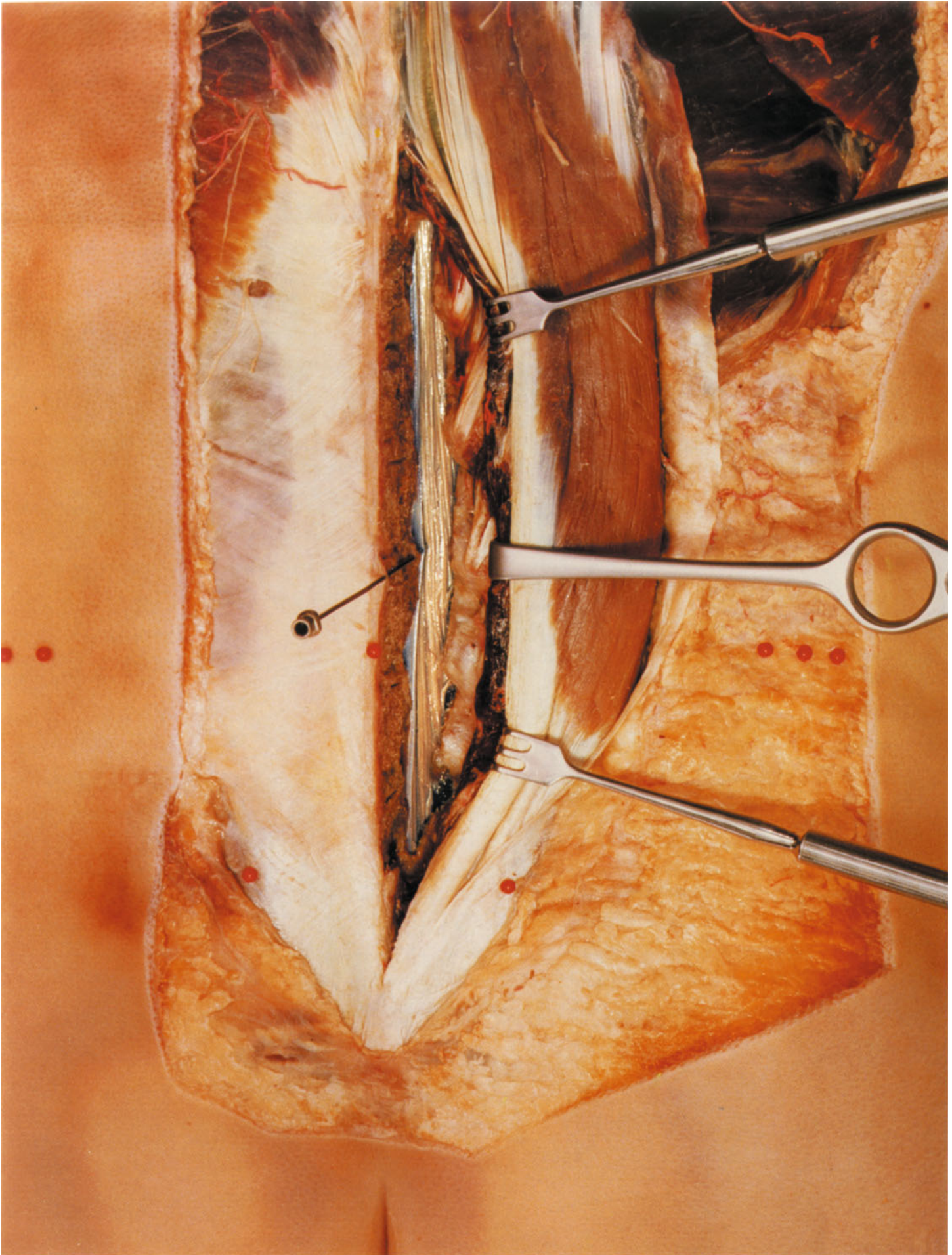


Figure 77**Lumbar Region
Intervertebral Disk
and Spinal Nerve Root**

With the **vertebral arches** exposed from behind, bean-sized prominences appear at an unexpectedly short distance from the line of the **spinous processes**. These areas, which are covered by a pale, glistening **fibrous layer**, originate from the lumbar **vertebral articulations** (see also Fig. 75). Passing laterally upward from these prominences are **tendons** that belong to the deepest plane of the **multifidus muscle**, which has been retracted laterally with the fleshy **longissimus muscle** belly.

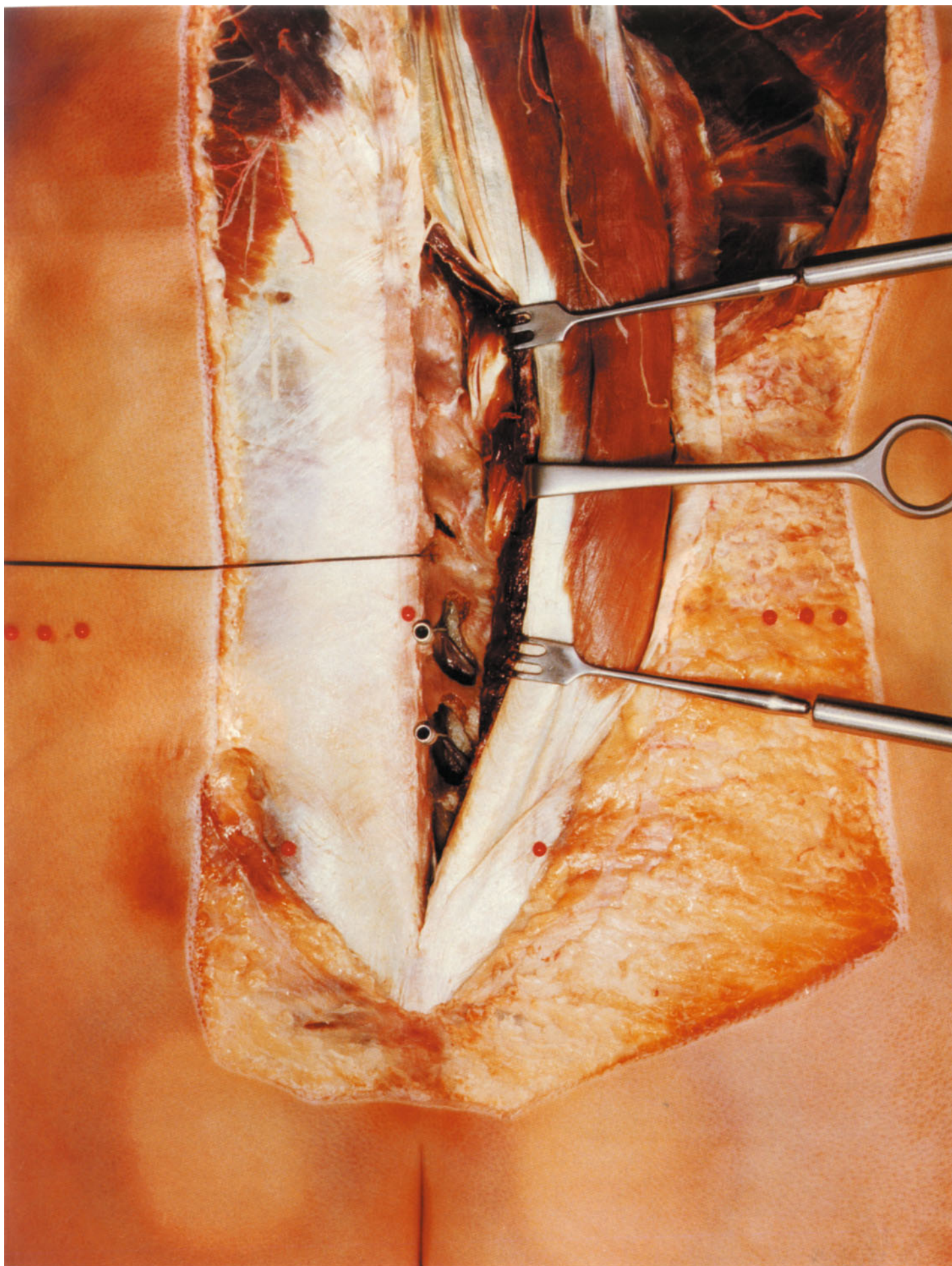
The prominences are covered by a fibrous joint capsule and contain the **superior articular processes** of the lumbar vertebrae laterally and the **inferior articular processes** medially. Their articular surfaces are sagittally oriented, and the upper ends of the superior articular processes bear the **mamillary processes** from which the foregoing tendons arise.

The upper border of a vertebral **lamina** curves forward around the **inferior process** of the next higher vertebra, passing to the anterior border of its **superior process**. This creates an imbricated pattern in which each lamina overlaps the one directly below it. As the dissection shows, the **ligamentum flavum** smoothes out this discontinuity by stretching from the inferior edge of the upper lamina to the posterior surface of the lower lamina.

The **ligamentum flavum** in the third lumbar intervertebral space has been incised and its lower portion elevated with a thread.

Portions of the opposing laminae have been resected from the fourth and fifth lumbar vertebrae. A needle has been inserted into the **intervertebral disk** to displace the **dural sac** slightly medially and expose the origin of the **posterior root** of the **fourth lumbar nerve**, which has been left within its dural sheath. The distal end of the root lies at the entrance to the **intervertebral foramen**, which is ventral to the middle third of the vertebral articulation.

Similar relationships are seen in the next lower segment, where a needle has been inserted into the **intervertebral disk** between the fifth lumbar vertebra and the sacrum.



Dissecting the deep surface of the **skin** from the **subcutaneous tissue** in this region exposes numerous pale streaks that follow the alignment of the **cleavage lines** (LANGER's lines) in the skin. They arise from subcutaneous connective tissue bundles that insert into the dermis as the **retinacula cutis**. These extensions form ridges on the deep surface of the skin and provide internal structural support for the **dermis**. Dividing them transversely creates a gaping wound that, when surgically reapproximated, tends to develop tension and form a large scar.

The **retinacula cutis** limit the mobility of the skin in accordance with the direction of their pull. The skin of the thoracic region has very limited mobility in the downward direction, but in the cranial direction it is quite mobile, indicating that the longitudinally oriented fiber tracts are connected to downward-directed connective tissue bundles. Similarly, the skin in front of the midaxillary line and below the breast has little mobility in the anterior direction, indicating the type of traction that is exerted by the more transversely oriented fiber tracts in this region.

Some of the **retinacula cutis** also transmit nerves and blood vessels to the skin and protect them from excessive stretching during passive movements of the integument.

The **tension lines** of the thoracic skin form a triangle extending from the **infraclavicular fossae** to the **xiphoid process**. The cleavage lines within this triangle show a longitudinal alignment, and the corresponding connective tissue strands clearly define the outlines of the triangle. More transversely oriented structures extending from the lateral border of this triangle outline the **mammary region**. In the area of the rectus sheath below the costal arch, the common integument is relatively adherent to underlying structures.

The **sternal region** lacks a conspicuous arrangement of connective tissue strands, but the **subcutaneous tissue** in this region is firmly adherent to underlying structures due to the paucity of fat within the skin.



The subcutaneous fat has been removed, and a segment of the **deep layer of the stratum subcutaneum** shaped like a butterfly wing has been resected over the lower part of the pectoralis major muscle near the costal arch. The exposed **superficial pectoral fascia** has been incised over the **pectoralis major muscle**. Thin fat pads, some previously covered by the deep layer of the stratum subcutaneum and some still covered in the infraclavicular region, are applied to the pectoral fascia at sites where the fascia is traversed by larger blood vessels.

The **superficial pectoral fascia** is very thin in the infraclavicular region, appearing almost as a simple **external perimysium**. It is much thickened inferiorly as it continues over the origin of the **external oblique muscle** to the start of the rectus sheath, where it blends with the **peritendineum** of that aponeurosis. Consequently, when the muscles are dissected above the rectus attachment, any attempt to develop the plane downward inevitably carries the dissection beneath the rectus sheath, creating a problem for the less experienced dissector.

The two layers are somewhat more adherent below the clavicle, at the sternum, and at the lateral border of the pectoralis major muscle. This creates a **subcutaneous pectoral space**, which forms a potential route of spread for subcutaneous pectoral inflammatory processes. The two layers are not adherent along the lateral part of the costal arch, where the **deep layer of the stratum subcutaneum** blends with the loose SCARPA fascia of the abdomen.

The deep layer of the stratum subcutaneum becomes continuous with the **superficial axillary fascia** via their fusion at the lateral border of the **pectoralis major muscle**.

The mammary gland of this male cadaver has been freed from the subcutaneous fatty tissue, and the **nipple** has been dissected. Attached to the nipple by a short pedicle is a small mass of connective tissue representing the **male mammary gland**, which contains only a few rudimentary lactiferous ducts. Located in the fourth intercostal space, the gland is supplied by a **medial mammary branch** of the **internal thoracic artery**.



The appearance of the chest varies not only between the sexes but also among different individuals according to the degree of muscular development.

The **pectoralis major muscle** defines much of the thoracic contour in muscular males. The origins of the **rectus abdominis** and **pectoralis major muscles** interdigitate on the fifth and sixth costal cartilages, the origin of the pectoralis muscle continuing from the **sixth costal cartilage** to the **sternum**, where its short tendons add substance to the **sternal membrane**.

This **sternocostal part** of the pectoralis major muscle is easily distinguished from its **clavicular part**, which arises from the clavicle, although the interval that separates the two parts is usually not as broad as in this specimen.

The **sternocostal part** of the pectoralis major muscle is bordered laterally by the **abdominal part** of the muscle, which arises from the anterior layer of the rectus sheath.

The lateral border of the muscle forms the **anterior axillary fold**. The skin behind it is hollowed to form the **axillary fossa**, and behind that is the **posterior axillary fold**.

The lateral cut surface shows that the fatty tissue between the two axillary folds consists of two layers separated by the **superficial axillary fascia**. This fascia, which corresponds to the **deep layer of the stratum subcutaneum**, divides the subcutaneous tissue from the fatty tissue of the axillary cavity.

Visible on the lateral chest wall are the interdigitating slips of the **external oblique** and **serratus anterior** muscles, which form **GERDY's line**. The **lateral branches** of the **intercostal nerves** emerge between the slips of serratus anterior, usually having already divided into anterior and posterior branches. They are accompanied by the **lateral branches** of the **posterior intercostal arteries**.



In males with poor muscular development and scant subcutaneous fat, the **chest contour** is defined by the thoracic cage. The ribs are easier to palpate in this type of subject, and they appear more prominent on visual inspection.

The fossae bordering the clavicle are deeper than in more muscular subjects. The **infraclavicular fossa**, formed by the interval between the **clavicular part** of the **pectoralis major** and the **deltoid muscle**, also appears broadened because the clavicular part of the pectoralis muscle is retracted due to the convexity of the thorax.

Both clavicles appear very prominent over their full length. This is partly because the clavicles in nonmuscular subjects tend to show less curvature in the horizontal plane.

In the **sternal region**, the origin of the pectoralis major muscle is the same as in muscular individuals, but of course there are no prominent sulci between the muscles on each side.

As always in the lower part of the sternum, a broad strip of the **sternal membrane** is left uncovered by musculature. The **radiate sternocostal ligaments** that contribute to the membrane and anchor the lowest costal cartilages overlap the origins of the **costo-xiphoid ligaments**, which arise from the sixth and seventh cartilages. These notably thick ligaments are interwoven with the highest connective tissue strands of the rectus sheath.

The **rectus sheath** becomes continuous above the costal arch with the **superficial pectoral fascia**. The sheath has been removed from the pectoralis major muscle and from the upper part of the **rectus abdominis muscle**, with accompanies it laterally upward to the cartilage of the fifth rib. The resulting margin, plainly visible on the right side, corresponds to the upper end of the anterior layer of the rectus sheath.



The **male breast** is located in the fourth intercostal space. It may be placed slightly higher or lower, however, and usually shows some asymmetry between the right and left sides. The male breast consists of a small, flat mass of subcutaneous connective tissue that is connected to the **nipple** (mammary papilla) by a very short pedicle. At its center is a fissured opening for the excretory ducts. The nipple is surrounded by the more heavily pigmented **areola**.

The breast derives most of its **blood supply** from the medial side via the **perforating branches** of the **internal thoracic artery**, which in this capacity are known also as the **medial mammary branches**. They emerge from the second or third intercostal space.

As the dissection shows, the main trunks of these vessels travel some distance from the **sternum** through **flat tunnels** before they enter the **subcutaneous tissue** – part of which has been resected to expose sections of the tunnels. The roof of the tunnels, formed by the **deep layer of the stratum subcutaneum**, has been opened and reflected at a point before the vessels pass more superficially to reach the **areola**. As their terminal branches traverse the subcutaneous tissue, they are accompanied by connective tissue that is part of the **retinacula cutis** described in Fig. 78. The white margins indicate the lines along which the tunnels have been opened.

Sufficient **subcutaneous tissue** has been resected to expose the **retinacula cutis** at their origins from the deep layer of the stratum subcutaneum. The pale streaks closely follow the alignment of the **cleavage lines** in the overlying skin.

The remaining arteries supplying the mammary gland, including the male breast, are described in later sections on the female breast, where they have greater practical importance.



Figure 83**Pectoral Region 6
Mammary Branches and Subcutaneous Tissue
Sternal Membrane**

The **subcutaneous fat** has been removed on the left side of the chest to expose the **deep layer of the stratum subcutaneum**. This layer is attached to the **superficial pectoral fascia** over large portions of the pectoralis major muscle but separates from it over the main trunks of the **medial mammary branches** to form a roof for the flat tunnels through which the arterial branches pass.

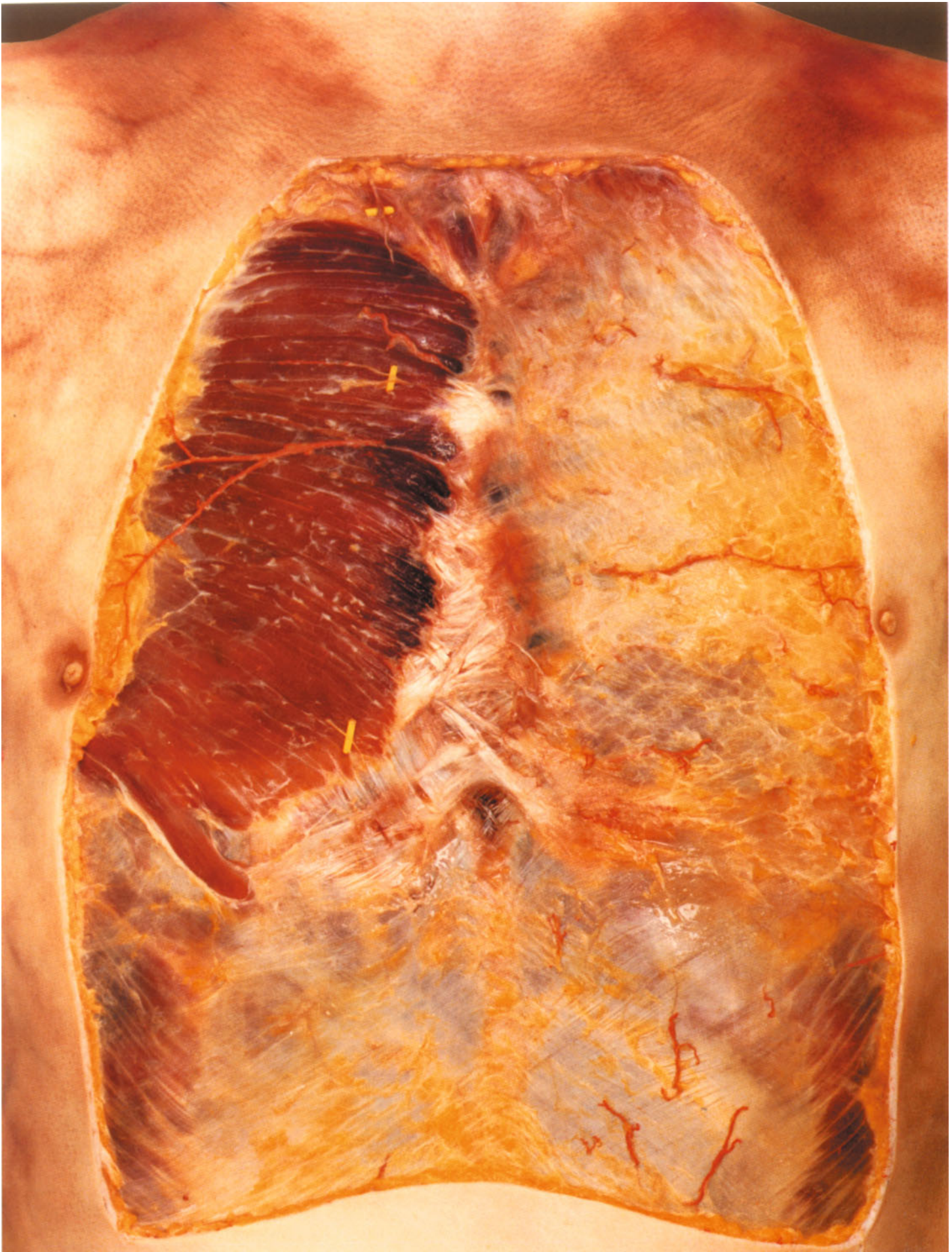
The flat tunnels open into a thin fat pad created by the general elevation of the deep layer of the stratum subcutaneum. Part of this layer reaches the breast as a **subcutaneous fascia** that is traversed by peripheral arterial branches supplying the mammary tissues.

A narrow strip has been resected from the deep layer of the stratum subcutaneum over the course of the vessels to show the vessels in isolation.

The fascial layers on the right side of the chest have been removed to demonstrate the sites where the **medial mammary branches** pierce the **pectoralis major**. This dissection also shows how the pectoralis major tendons relate to the **sternal membrane**.

The **pectoralis major muscle** covers almost all of the **manubrium sterni**, and its tendinous origins form the bulk of the **sternal membrane** in that region. But from the **sternal angle** downward, the sternum is enveloped by a thick, closed membrane formed chiefly by the intermingling fibers of the **radiate sternocostal ligaments**. Especially at its lower end, the sternum is covered by thick, interwoven fiber bundles passing from the fifth, sixth, and seventh costal cartilages on one side to those of the opposite side.

These bundles are connected below to the thick **costoxiphoid ligaments**, above to the tendinous origins of the **pectoralis major muscle**, and laterally to the upper border of the anterior layer of the **rectus sheath**.



Most of the **pectoralis major muscle** on the left side of the chest has been resected to expose the thoracic cage with the **sternocostal joints** and **sternocostal ligaments**.

The **pectoralis major muscle** on the right side has been preserved to show how its tendons of origin contribute to the formation of the **sternal membrane**.

Medial to the nipple are several resected costal origins of the **pectoralis major muscle**, illustrating a variant in which the origins are initially separate from the muscle.

The **pectoralis minor muscle** is still covered by the **clavipectoral fascia**. Below this fascia, fatty deposits obscure the junction of the muscle with its tendinous origins on the third and fourth ribs.

Medial to pectoralis minor, the **internal intercostal muscles** can be seen in the **intercostal spaces**. Each of the muscles passes laterally and obliquely from the upper rib and its cartilage to the next lower rib and its cartilage. They are covered by the mostly transparent **external intercostal membrane**, which is continuous with the **external intercostal muscles**.

At the sternal end of the intercostal space, the bundles of the **internal intercostal muscles** assume a more vertical orientation to maintain closure of the space in that area. The tagged **anterior cutaneous branches** of the intercostal nerves emerge between these muscle bundles, often having already split into smaller branches at that level. They pass to the deep surface of the **pectoralis major muscle** and pierce it. They give off the **medial mammary branches** from the second to fourth thoracic segments.

The same muscle bundles are pierced near the sternal margin by **perforating branches** of the **internal thoracic artery**, which may occur as **medial mammary branches** from the second to fourth intercostal space. At a more lateral site in the third and fourth intercostal spaces, branches of the **intercostal arteries** emerge from the internal intercostal muscles as the **lateral mammary branches**.



The pectoralis major muscle has been removed, and the **internal intercostal muscles** have been resected lateral to the sternum. Just deep to the resected intercostal muscles is the **internal thoracic artery** (internal mammary artery). Its two **venae comitantes** converge above the third intercostal space to form a larger **vein** that runs medial to the artery and drains superiorly into the brachiocephalic vein.

The **vascular bundle** descends along the **sternum** in a slightly medially convex curve, approaching within a fingerwidth of the sternum in the second intercostal space.

The **vascular bundle** directly overlies the **pleura** in the upper two intercostal spaces. From the third intercostal space downward, the **transversus thoracis muscle** intervenes between the vascular bundle and the pleura. Adjoining the transversus thoracis muscle are the **parasternal lymph nodes**, which form a chain, greatly reduced in old age, that contributes to the intercostal drainage of the breast. The presternal network of lymphatic vessels accounts for the susceptibility of these nodes to bilateral and contralateral involvement by disease.

The ends of the **intercostal nerves** reach the vascular bundle at the lower margin of the ribs on the plane between the pleura and the internal intercostal muscles. The nerves cross in front of the vascular bundle, as shown by the two tags, before passing to the surface as the **anterior cutaneous nerves**.

The **internal thoracic arteries** give off numerous side branches. The **anterior intercostal arteries**, numbering two in each intercostal space, pass laterally and form anastomotic arches with the posterior intercostal arteries at the upper and lower margins of the ribs. The **perforating branches** emerge anteriorly, piercing the internal intercostal muscles, and one or more **sternal branches** run medially in each intercostal space. The sternal branches may arise separately or may form a common trunk with the perforating branches. The sternal branches communicate with a vascular plexus that is especially well developed in front of the manubrium sterni.



The morphology of the **female breast** or mammary gland is extremely diverse. The breast develops through numerous stages as the individual grows from infancy and childhood to puberty and sexual maturity. Pregnancy and lactation cause profound changes in the breast tissue, which returns to its “baseline” state after lactation is concluded.

Our description is based on the **nonlactating breast** of a **sexually mature woman**. The breast in this case is of moderate size, extending vertically from the third to the sixth rib. It covers a large portion of the **pectoralis major muscle** and, in the transverse plane, extends past the lateral border of that muscle to a point below the **axillary fossa**. The **nipple** occurs at about the vertical midpoint of this field, corresponding to the level of the fourth intercostal space described for the **male breast**.

The **transverse position** of the **nipple** usually deviates toward the lateral side, especially in nulliparous females. This circumstance, along with frequent idiosyncrasies in the shape of the breast, suggests that the **midclavicular line** is preferable to the “nipple line” as a vertical reference line for detailed anatomic descriptions in females.

The mammary gland lies within the **subcutaneous tissue** and is intimately related to it. With the **skin** removed, the transected **retinacula cutis** again appear as whitish streaks on the subcutaneous tissue surface that follow the cleavage lines of the skin. On the lateral side of the breast, connective tissue sheets insert into the skin and form compartments that are filled with fatty tissue. This gives the female breast a firm resilience that is particularly marked in breasts that have never lactated. The connective tissue attachments to the skin prevent the skin from being raised into folds but still allow for adequate skin mobility.

The very thin skin of the **areola** has been resected to display the underlying connective tissue, which is devoid of fat and is in direct continuity with the firmer fibrous breast tissue. It is traversed by delicate vessels that supply the areola.



The large arteries of the **female breast** lie deep within the **subcutaneous tissue** and do not closely approach the surface of the breast. Even near the nipple, they are usually about one-half centimeter deep. The skin has been dissected from the **areola**, and surrounding fat has been removed from the breast. The connective tissue of the breast is permeated by fat and contains a relatively small volume of **lactiferous ducts**. Superficially, it forms ridge-like processes that are bound to the **skin** by sheets of connective tissue that form compartments for the superficial fat.

This dissection shows a common pattern in which the breast derives most of its blood supply from the **perforating branch** of the **internal thoracic artery (internal mammary artery)** that emerges from the second intercostal space. It is almost as common for the perforating branch from the third intercostal space to furnish most of the blood supply.

In addition to this supply from the medial side, the gland is supplied laterally by the **lateral thoracic artery** and from below by the **lateral mammary branches** of the intercostal arteries.

A **medial mammary branch** from the **second perforating branch** unites with branches of the **lateral thoracic artery** about the **areola** to form an inferiorly open **ring** that anastomoses with a **lateral mammary branch** from an intercostal artery. This ring gives off small radial vessels that supply the **nipple** and **areola**. Part of the vascular ring is overlapped by breast tissue, which is not unusual.

MARCUS notes that the arteries do not always form a ring or loop. But most of the vessels still undergo multiple anastomoses, as this dissection clearly shows.

For simplicity, the perforating branches in this atlas are numbered according to their order of emergence from the intercostal spaces, disregarding the highest perforating branch of the thoracic artery that emerges between the clavicle and first rib (see Fig. 84). It would be confusing to number the branches strictly by their intercostal spaces, as two branches may emerge from the same space.



Here the dissection is viewed from a more lateral angle to demonstrate the lateral blood supply to the breast. MARCUS states that this supply is present in slightly more than 50 % of the population.

In descriptions of the blood supply to the breast, it is common to make no distinction between the **lateral thoracic artery** and the **superficial thoracic artery** (of MANCHOT), because the latter vessel does not appear in the anatomic nomenclature.

The **superficial thoracic artery** (of MANCHOT) arises separately from the **axillary artery** and reportedly occurs with some consistency. The author describes it as descending along the lateral border of the **pectoralis major muscle**, giving off one to three branches that usually pass directly to the **areola**. This description is related here because it is consistent with the findings in this dissection.

In other cases the superficial thoracic artery may be replaced by branches of the **lateral thoracic artery**, which pursues a highly variable course. But it is always covered to a substantial degree by the **pectoralis major muscle**, so its branches frequently have to pierce that muscle on their way to the breast. The cutaneous branches of the **thoracoacromial artery** are of much less importance in supplying the upper part of the breast.

The branches of the **superficial thoracic artery** (of MANCHOT) contribute to the partially buried arterial **ring** about the areola or give off direct radial branchlets to the **nipple**, as shown in this dissection.

Below the nipple, a side branch of a **lateral mammary branch** of the intercostal artery that anastomoses with the circumareolar vascular ring has been dissected free.

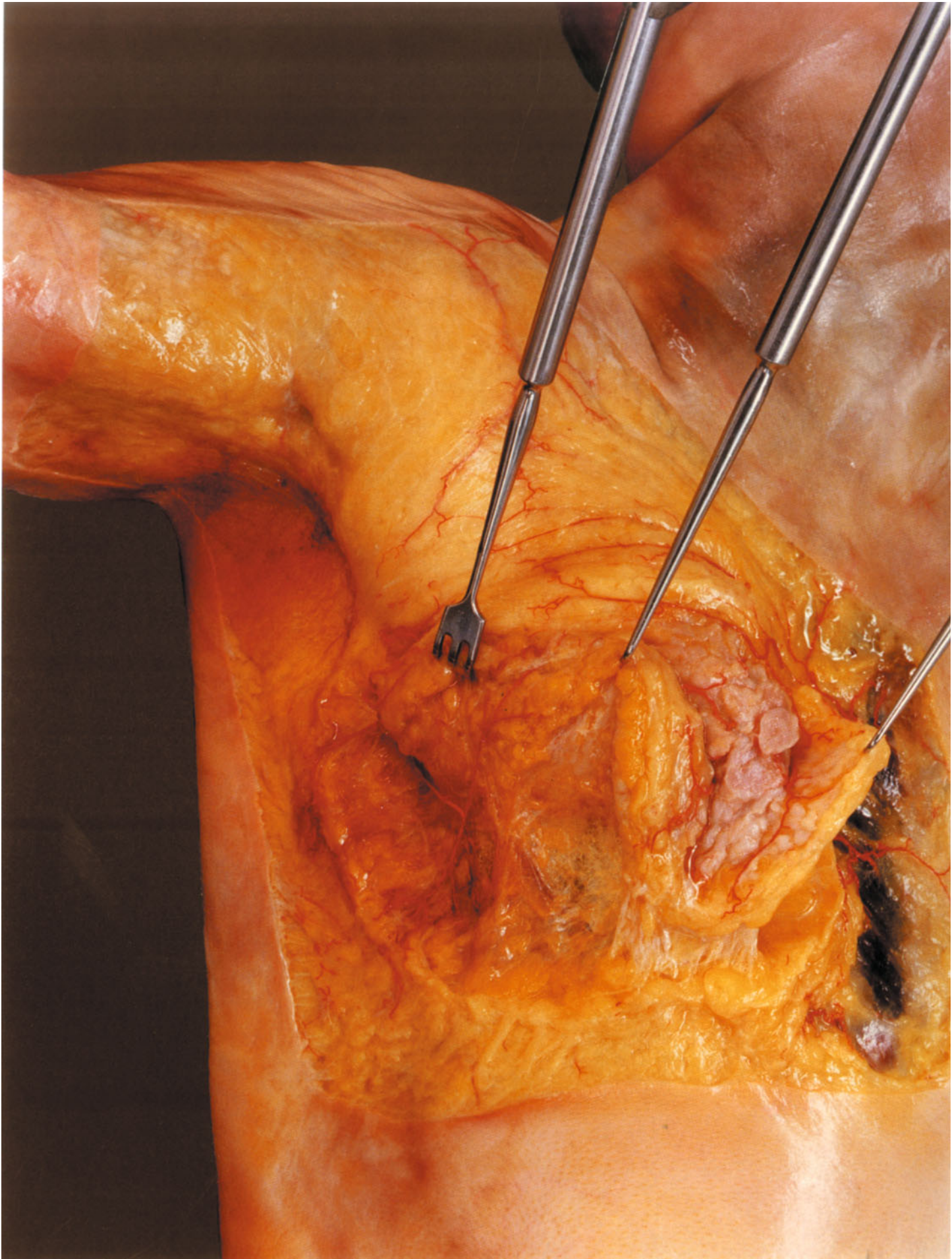


The **subcutaneous tissue** has been incised circumferentially around the **breast**, leaving its upper portion intact, and the gland has been elevated somewhat from the **pectoralis major muscle** in continuity with the mobilized subcutaneous tissue. This places tension on the strong **inferior suspensory ligament** of the breast, which, judging by its position, represents a thickened portion of the **deep layer of the stratum subcutaneum**. The inferior suspensory ligament is attached to the border of the fibrous breast tissue near its posterior surface.

The **deep layer of the stratum subcutaneum** on both sides of this powerful ligament has been divided with the subcutaneous tissue, exposing its deep surface. The **superficial thoracic artery** (of MANCHOT) with its partially divided mammary branches is visible in the lateral portion of the field.

Elevating the fibrous breast tissue from the pectoralis major muscle places tension on the loose connective tissue that lies between the **superficial pectoral fascia** and the gland. This loose connective tissue imparts a **mobility** to the breast that is limited only by the **suspensory ligaments** of the breast. In a breast that has never lactated, this plane is occupied by a thin layer of fat. Once lactation has occurred and the fat and connective tissue have been replaced by true glandular parenchyma, fat deposition on the plane generally does not recur.

Despite the direction of its fibers, we cannot conclude that the **inferior suspensory ligament** functions as a simple checkrein against superior displacement of the breast. Owing to its considerable width, the ligament also limits extreme mediolateral breast displacements and prevents excessive elevation of the breast from the chest wall – a function that is aided by other suspensory ligaments (Figs. 90, 91) that anchor the sides of the inferior ligament to the chest wall.



With its **inferior suspensory ligament** divided, the **breast** has been separated from the underlying **pectoralis major muscle** and reflected upward. The continuous layer of **fat** on its exposed undersurface is a sign that the breast has never lactated. When lactation occurs, this fatty layer and the intramammary fat are replaced by glandular parenchyma, and generally they do not recur.

This fatty layer is bound by loose connective tissue to the transparent **superficial pectoral fascia**, which allows for motion of the breast on the chest wall. Circumscribed deposits that may represent very limited extensions of breast tissue into the **pectoralis major muscle** are visible on the plane between the superficial pectoral fascia and the muscle.

In males, the **deep layer of the stratum subcutaneum** gains firm attachment to the lateral border of the **pectoralis major muscle** before it continues into the **superficial axillary fascia**. In females, the mammary gland raises this subcutaneous layer into an eminence that is clearly distinguished from the superficial axillary fascia. It is anchored to the posterior surface of the lateral border of the pectoralis muscle and is thickened inferiorly to form a distinct lateral **suspensory ligament** for the breast.

The approximation of the **deep layer of the stratum subcutaneum** to the lateral border of the **pectoralis major muscle** creates a flat tunnel that transmits the **superficial thoracic artery** (of MANCHOT). This tunnel has been opened following separation of the deep layer of the stratum subcutaneum from the breast.

Structures visible at the lateral border of the **pectoralis major muscle** include the superficial thoracic artery (of MANCHOT) along with mammary branches of the **lateral thoracic artery**, one of which pierces the muscle. In this case, then, the breast is supplied concurrently by both of its potential lateral sources.



The **breast** has been completely elevated from its **bed** and reflected laterally, exposing the superior attachment by which it is suspended. That consistent structure is the **superior suspensory ligament** of the breast – actually a thickened portion of the **deep layer of the stratum subcutaneum** that stretches to the breast margin.

The **incision** through the **deep layer of the stratum subcutaneum** completely encircles the bed of the mammary gland and demonstrates the variable thickness of that layer.

The thickest part of the lower cut edge is from the **inferior suspensory ligament** of the breast, which is continued medially into a moderately thick sheet that may be termed the **medial suspensory ligament**.

A fixed, thickened portion of the deep layer of the stratum subcutaneum arises from the posterior surface of the inferolateral border of the **pectoralis major muscle** and curves around the edge of the muscle to form a **lateral suspensory ligament** for the breast. Its medial portion is joined to the **inferior suspensory ligament**.

Thus, the **inferior suspensory ligaments** of the breasts form a coherent arch that basically corresponds to the suspensory ligaments of COOPER.

Considering the modest strength of the superior suspensory ligament compared with the inferior ligament, it is not surprising that as the breast enlarges, it tends to sag and become pendulous or ptotic, with a deep crease separating the breast from the chest wall.



The **breast** does not have a well-defined circular boundary but tends to assume a transverse elliptical shape with a marked superolateral extension of the breast tissue, the **axillary tail**. As a result, a sagittal section through the breast will reveal less glandular tissue mass in the lower half than above the nipple, where an incision carried the full length of the axillary tail (as in this specimen) will display a long segment of mammary tissue.

The **axillary tail** extends along the lateral border of the **pectoralis major muscle** to the **axillary fossa** and thus lies in close relationship to the axillary **lymph nodes**. If the end of the axillary extension is not clearly defined, it might even be mistaken for nodal tissue. The axillary tail relates posteriorly to the lateral border of the pectoralis major muscle and, during pregnancy, often forms a perceptible swelling below the arm.

As the **cut surface** of the specimen demonstrates, the conical body of the mammary gland contains more fat in its central portions while the peripheral portions, which are more active during the onset of lactation, have a denser tissue structure.

The **nipple-areola** of this specimen has been circumscribed and retracted with a small hook. Below the areola is an area of relatively loose connective tissue, devoid of fat, that is traversed by the convergent excretory portions of the **lactiferous ducts**. The incision displays longitudinal sections of several of the **lactiferous sinuses**, which number more than a dozen and become thicker than straws during the lactation period. They are accompanied by delicate blood vessels that ascend to the nipple.

The larger blood vessels indicate that this specimen is the medial half of the breast shown in the previous figure. The connective tissue containing the **lactiferous ducts** and their terminal buds has a reddish-white color and is clearly demarcated from the surrounding yellowish fat.

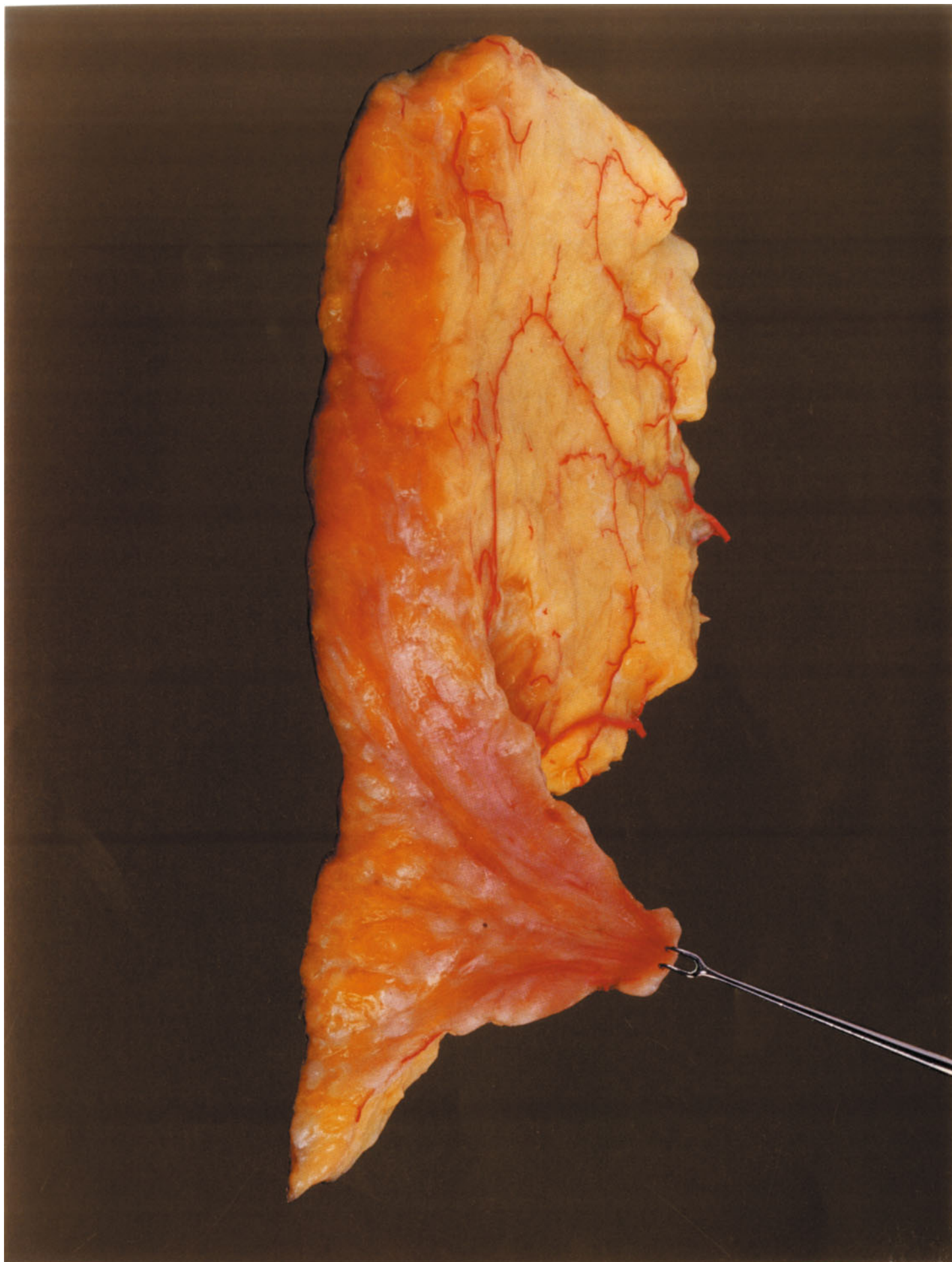


Figure 93**Female Breast 8
Attachment of the Skin
Venous Drainage**

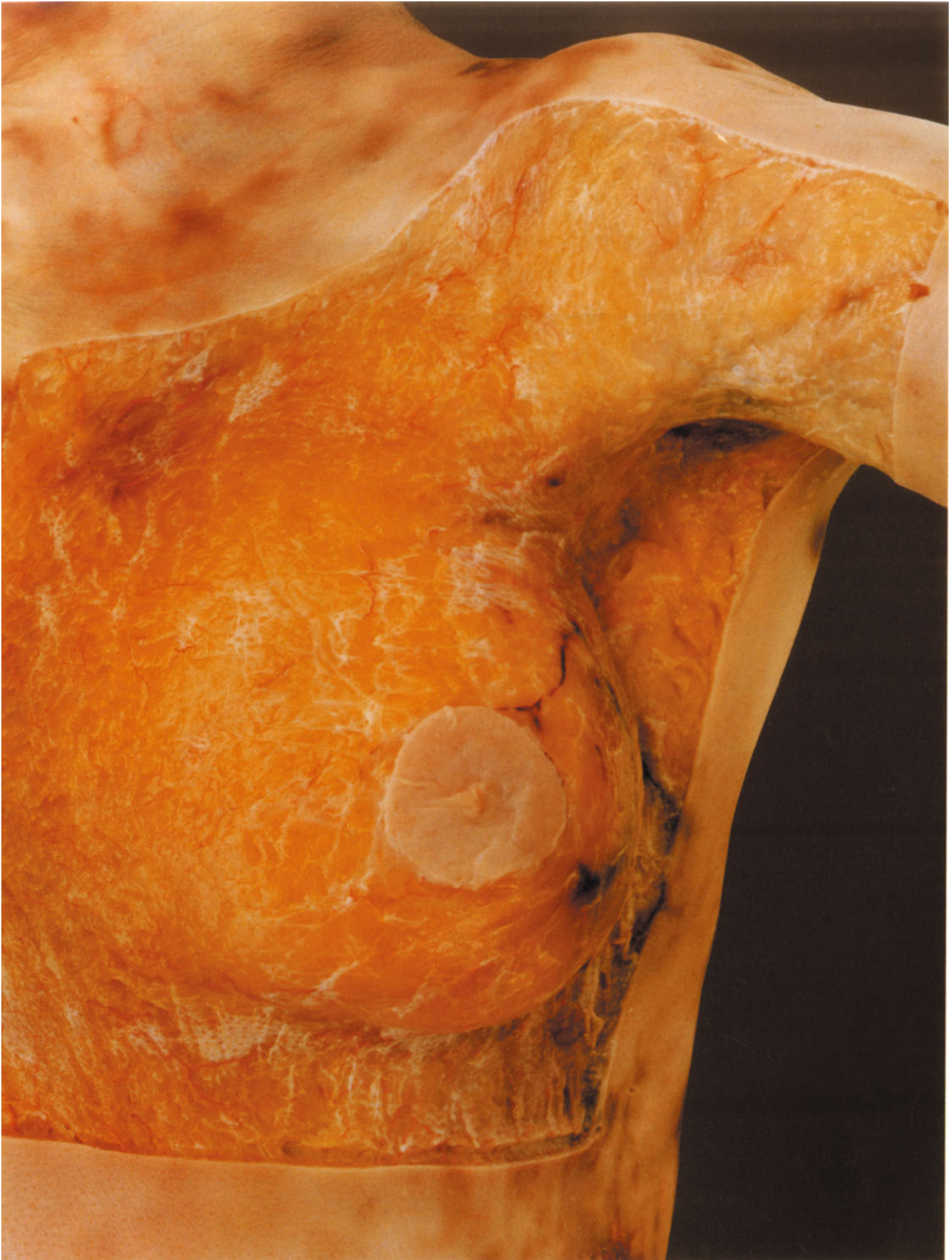
The **skin** has been dissected off the breast, leaving the surface ridges to which the anchoring **retinacula cutis** are attached. Again we see a pattern of pale streaks conforming to the **cleavage lines** of the **skin**.

The pattern above the **breast** shows a predominantly transverse orientation with slight concentric adaptation about the **areola**. It is crossed at right angles by streaks that show a more radial orientation about the nipple. In accordance with this pattern, the **subcutaneous fat** over the breast is enclosed and compartmentalized by **connective tissue septa** that pass to the skin from the connective tissue ridges of the mammary gland.

In the nonlactating breast, the tension in these compartments, rather than the size of the mammary gland, determines the firmness of the female breast, since even the nulliparous breast consists mostly of fatty tissue.

The thick expansions at the upper margin of the breast are **retinacula cutis** that are part of the **superior suspensory ligament** of the breast. Their functions include holding the mammary skin in place while the individual is in an upright posture. We are not surprised to find that the connective tissue elements of this well-shaped breast are finely developed, as evidenced by the prominent fibrous streaks that the skin dissection has left on the subcutaneous tissue.

Several vessels are visible that drain the **superficial venous network** of the breast. The superficial venous network lies just deep to the **skin** and is visible through it, especially in the lactating breast. The network includes the subareolar circulus venosus (of HALLER) and is drained primarily by the deep veins of the breast. Deep veins accompany the supply arteries without directly adjoining them, and the veins draining to the sternal side are larger and more numerous than the arterial perforating branches. All the veins become greatly dilated during **lactation**.



This figure shows a less common pattern of vascular supply in the breast. Note particularly that the areola is supplied by a **perforating branch** from the **first** intercostal space that has given off a **medial mammary branch**. It is also somewhat unusual to find the nipple supplied by **lateral mammary branches** from the intercostal vessels.

The groove that was cut to locate the main arterial vessels is well preserved within the firm fatty tissue and clearly shows the depth of those vessels in the **subcutaneous tissue**. The vessels take a more or less tortuous course, depending on the position of the breast, and are accompanied by large veins only in the vicinity of the sternum.

The **perforating branch** from the **second** intercostal space, which usually supplies the breast as the **medial mammary branch**, is not distributed to the breast in this specimen, but a **perforating branch** from the **third** intercostal space is distributed to the areola. The perforating branch from the fourth intercostal space rarely supplies the breast and does not do so in this specimen.

The intercostal vessels from the third through fifth intercostal spaces sometimes give off **lateral mammary branches** that are distributed only to the basal portions of the breast. MARCUS states that only about one in five breasts is supplied by a branch from the third or fourth intercostal space. These lateral mammary branches enter and supply the anterior lower quadrant of the breast, as they do in this specimen.

The superficial arteries in this dissection show severe degenerative changes like those commonly seen in the breasts of elderly women. More than a century ago, COOPER commented on the frequent obliterated condition of these vessels and the extreme difficulty of injecting them.



In the specimen from the previous figure, the branches of the **lateral thoracic artery** have been dissected free and the breast retracted medially with two hooks.

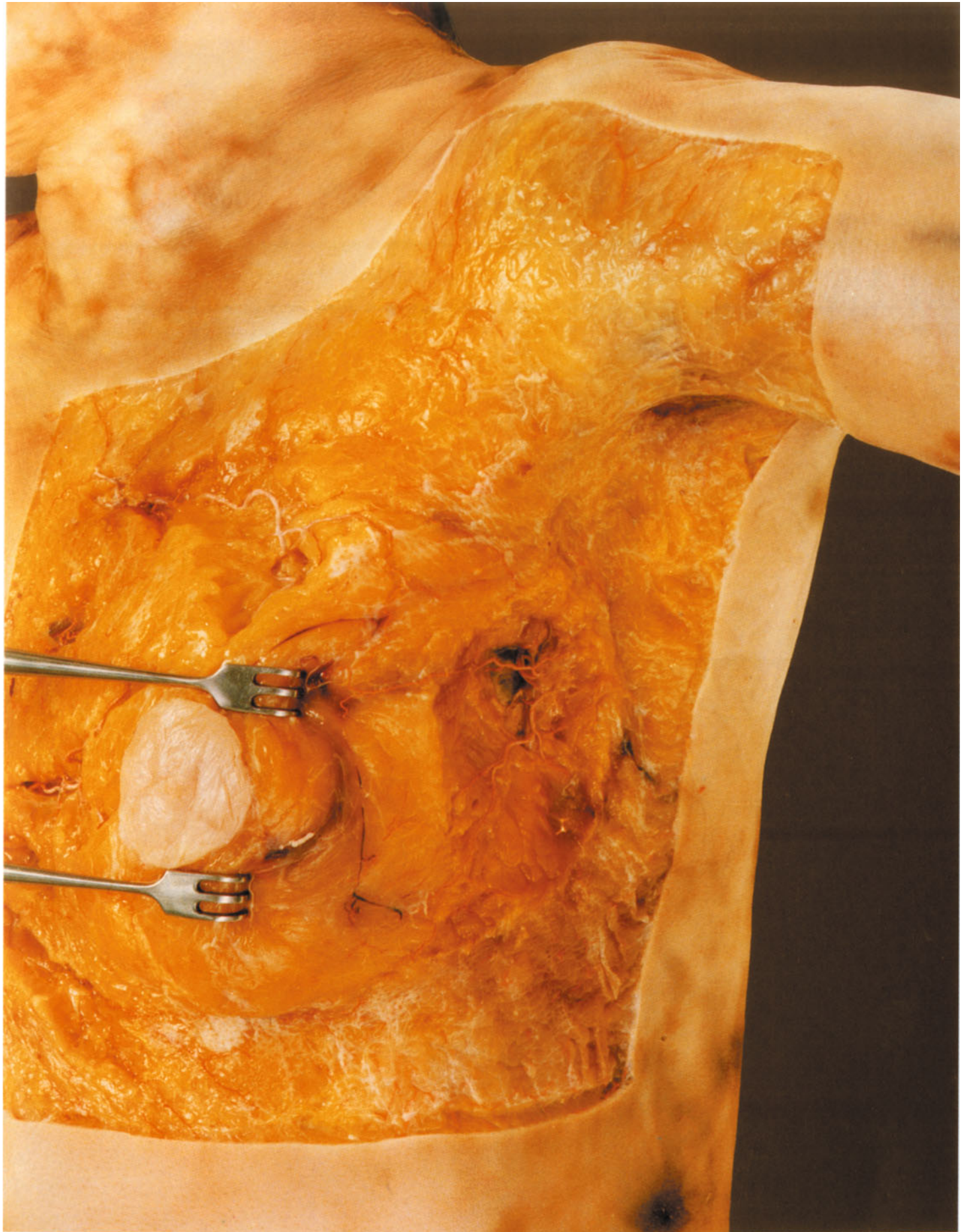
It is apparent that the branches of the **lateral thoracic artery** lie deeper in the **subcutaneous tissue** than the **medial mammary branches**.

The **lateral thoracic artery** gives off an upper and a lower branch. The upper branch passes toward the nipple, where it usually (as here) contributes to the **circulus arteriosus** about the **areola**. The lower branch, when well developed, may also connect with other mammary branches below the nipple, especially a lateral mammary branch, and also contribute to the formation of an arterial ring.

The **lateral thoracic artery** is accompanied by a large vein that may unite with the superficial epigastric vein to form the **thoracoepigastric vein**.

The **lateral thoracic artery** is highly variable. It may be absent, or it may exchange territories with the **thoracodorsal branch** of the **subscapular artery**. In other cases it may be duplicated or it may receive an **accessory thoracic artery** from the subscapular artery. It may share its territory with the frequently occurring **superficial thoracic artery** (of MANCHOT) (see Fig. 88).

The **lateral thoracic artery** differs from the **superficial thoracic artery** (of MANCHOT) in that its initial segment is in contact with the **serratus anterior muscle** and is covered by the **pectoralis major muscle** before the vessel becomes subcutaneous.



The **thorax** has been opened between the bony portions of the ribs from the center of the **manubrium sterni** to the root of the **xiphoid process**. The structures of the **mediastinum**, located between the **pleural cavities**, are sagging somewhat due to the supine position of the cadaver.

A thumb-wide strip of **costal pleura** has been preserved and reflected at its junction with the **mediastinal pleura**. This is the site where the normally slitlike cavity of the **costomediastinal recess** occurs. The **anterior border** of the collapsed, heavily anthracotic lung has retracted out of the recess.

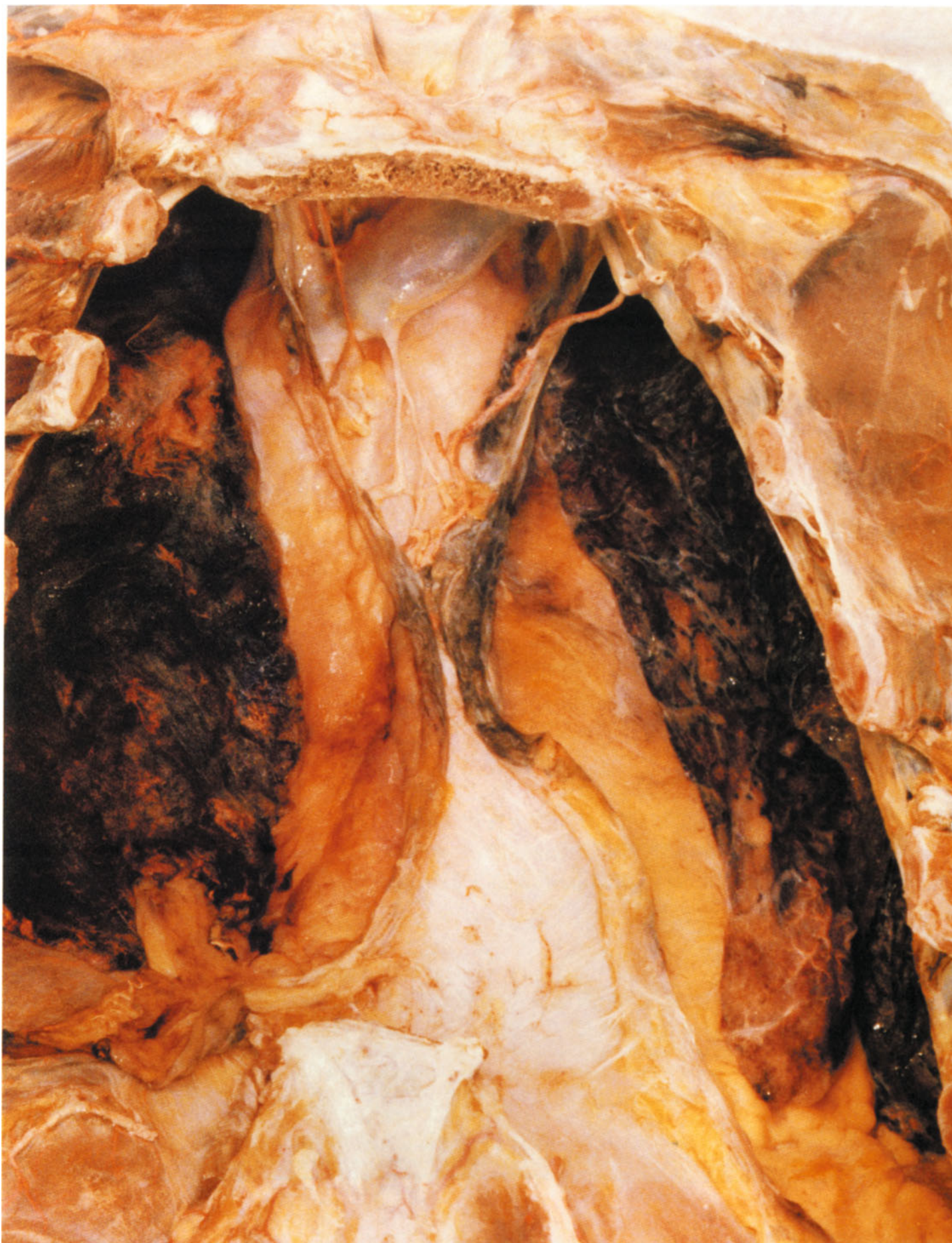
The **costomediastinal recesses** on both sides lie in close proximity to each other between the second and fourth ribs. Above and below those levels, the recesses diverge to form the boundaries of upper and lower triangular interpleural areas.

The slightly expanded upper triangle, called the **superior interpleural area**, is traversed anteriorly by the **left brachiocephalic vein**, which passes behind the **manubrium sterni** and is joined from below by a **thymic vein**. The **aortic arch** and the pericardium-enclosed **ascending aorta** are visible below the brachiocephalic vein.

Thymic arteries, which usually arise directly from the **internal thoracic arteries**, pass to the remnants of the retrosternal fat pad. A large thymic artery sometimes has a large distal connection with the **pericardiophrenic artery** and may serve as its main supplier.

The lower interpleural triangle, called the **inferior interpleural area**, contains the **pericardium**, which was joined to the **sternum** in this region by broad but rather thin ligaments.

The **costomediastinal recess** ends inferiorly at the site where it unites with the **costodiaphragmatic recess** and the **phrenicomediastinal recess**. Just as a very thick layer of fat may occur in places between the pericardium and mediastinal pleura, lobular folds of fat may be found within the **pleural recesses** of well-nourished individuals.



The **mediastinal surface** of the **right lung** has been separated and retracted from the **mediastinum**, which is covered by **mediastinal pleura**. This exposes the anterior aspect of the **lung root**, over which the parietal pleura becomes continuous with the visceral pleura.

The **parietal pleura** is named for the structures to which it is applied. The lower part of the **mediastinal pleura** also covers the **pericardium**, which is slightly elevated from the right atrium of the heart by a fold. In the sagittally oriented **phrenicomedial recess**, a piece of pleura has been resected over the subpleural fat to demonstrate the **right phrenicopericardial ligament** (of TANDLER).

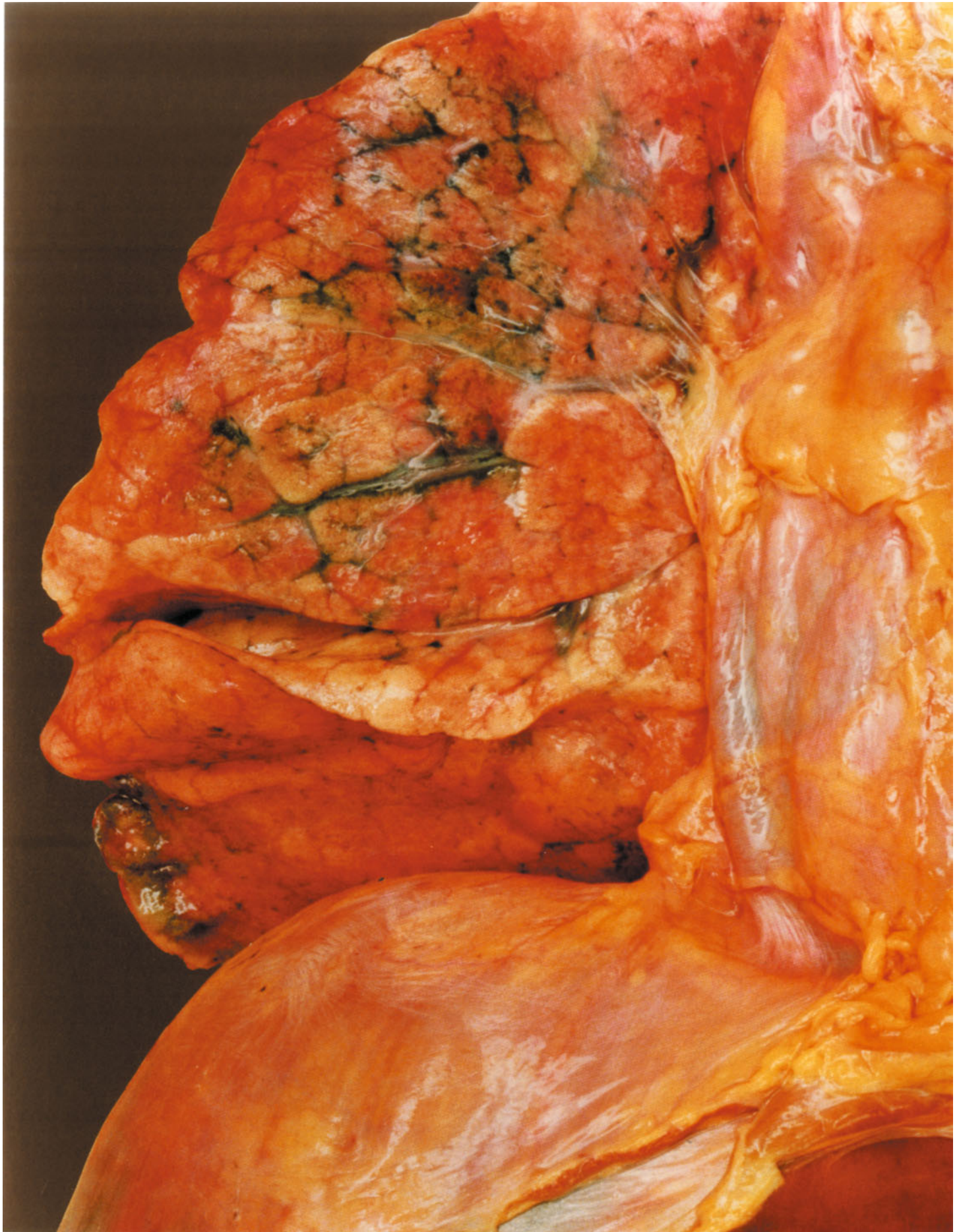
Above the lung root, the **mediastinal pleura** covers the **superior vena cava**. The **azygos vein**, appearing as a slight bulge, enters the superior vena cava from behind. A large subpleural fat pad covers the site where the superior vena cava enters the pericardium.

Delicate pleural adhesions are visible about the proximal part of the **lung root**, signifying a previous episode of circumscribed pleurisy.

The lung has been separated from the diaphragm to display its **diaphragmatic surface**. The gaping **oblique fissure** can be seen between the **lower lobe** and **middle lobe**. The lower lobe contributes to the **mediastinal surface** of the lung near the **pulmonary hilum**, and the middle lobe forms part of its **diaphragmatic surface** near the pulmonary **anterior border**.

The short **horizontal fissure** separating the middle lobe from the upper lobe is fused, as it is in many individuals. In rare cases this fissure may be completely absent.

The lung surface, covered by **pulmonary pleura**, features small areas whose organization into **pulmonary lobules** is marked by the deposition of anthracotic pigment in the **interlobular septa**. Each of the pulmonary lobules contains an average of five or six **acini** at its surface and is approximately 2–3 cm wide. The lobules vary markedly in size, however, those near the anterior lung border being much smaller than those near its massive posterior border.



The lung bears heavy **anthracotic deposits** like those typically found in smokers. The **fissures** are fused and fibrotic due to prior inflammatory processes that have not affected the lung root.

To display the lung root in situ, the lung has been pulled forward from the opened chest and the **costal pleura** has been divided and retracted with threads, opening up the **costomediastinal recess** and **costodiaphragmatic recess**.

A pleura-covered **fat lobule** has been retracted from the **phrenicomedial recess** to a site between the other two recesses. The **costomediastinal recess** is continuous superiorly with the **pleural dome**.

While fatty tissue does not occur below the **diaphragmatic pleura** (except near its recess), copious fat is present between the **pericardium** and the **mediastinal pleura**.

The large **azygos vein** forms a bulge in the **mediastinal pleura** above the lung root, and just anterior to it the **phrenic nerve** descends along the bulge of the **vena cava**, which is covered by pleura. The **pericardiophrenic artery**, visible without dissection, approaches the phrenic nerve and descends with it in front of the lung root, passing between the **pericardium** and **mediastinal pleura** on its way to the diaphragm.

The **superior right pulmonary vein** appears as a bulge at the lung root. Between its branches a **bronchopulmonary lymph node**, blackened by carbonaceous deposits, is visible through the pleura.



When the pleura is removed from the root of the right lung, the first structure to appear is the **superior right pulmonary vein**, as it occupies the most anterior position. Above and behind it is the **right pulmonary artery**, which covers the right main bronchus.

The vessels divide into their branches at the **hilum** of the lung. By pushing the lung tissue aside, the dissector can easily trace the vascular branches a short distance into the lung.

The veins of the lung root are of special importance because they mark the path to the **intersegmental veins**, which have major significance in pulmonary surgery. A detailed exploration of intrapulmonary anatomy would exceed our scope, but the pathway to that anatomy is formed by the structures comprising the lung root.

Each lung can be subdivided into 10 segments that constitute **bronchovascular units**. At the center of each segment is a segmental bronchus and a segmental artery, while venous drainage beyond the intrasegmental level is handled by vessels that pass through the periphery of the segment and lie between the pulmonary segments. These **intersegmental veins** provide essential surgical landmarks for identifying the intersegmental plane.

The trunk of the **superior right pulmonary vein** has an **apical branch** (V1) that passes upward and an **anterior branch** (V3) that passes forward. Both branches also may arise separately.

The intersegmental vein (pars intersegmentalis) that enters V3 lies between the anterior segment of the upper lobe and the lateral segment of the middle lobe. This makes it an important landmark for locating the cleavage plane in cases where the upper and middle lobes are fused together.

The infralobar tributary (pars infralobaris) of the **posterior branch** of the superior right pulmonary vein (V2) lies between the posterior segment of the upper lobe and the apical segment of the lower lobe.

The **middle lobar branch** (V4, V5) has a lateral part and a medial part that drain both segments of the middle lobe.

At a lower and deeper level, the **inferior right pulmonary vein** can be seen entering the hilum of the lower lobe. (Although the veins emerge from the hilum, “enter” is used for descriptive convenience.)

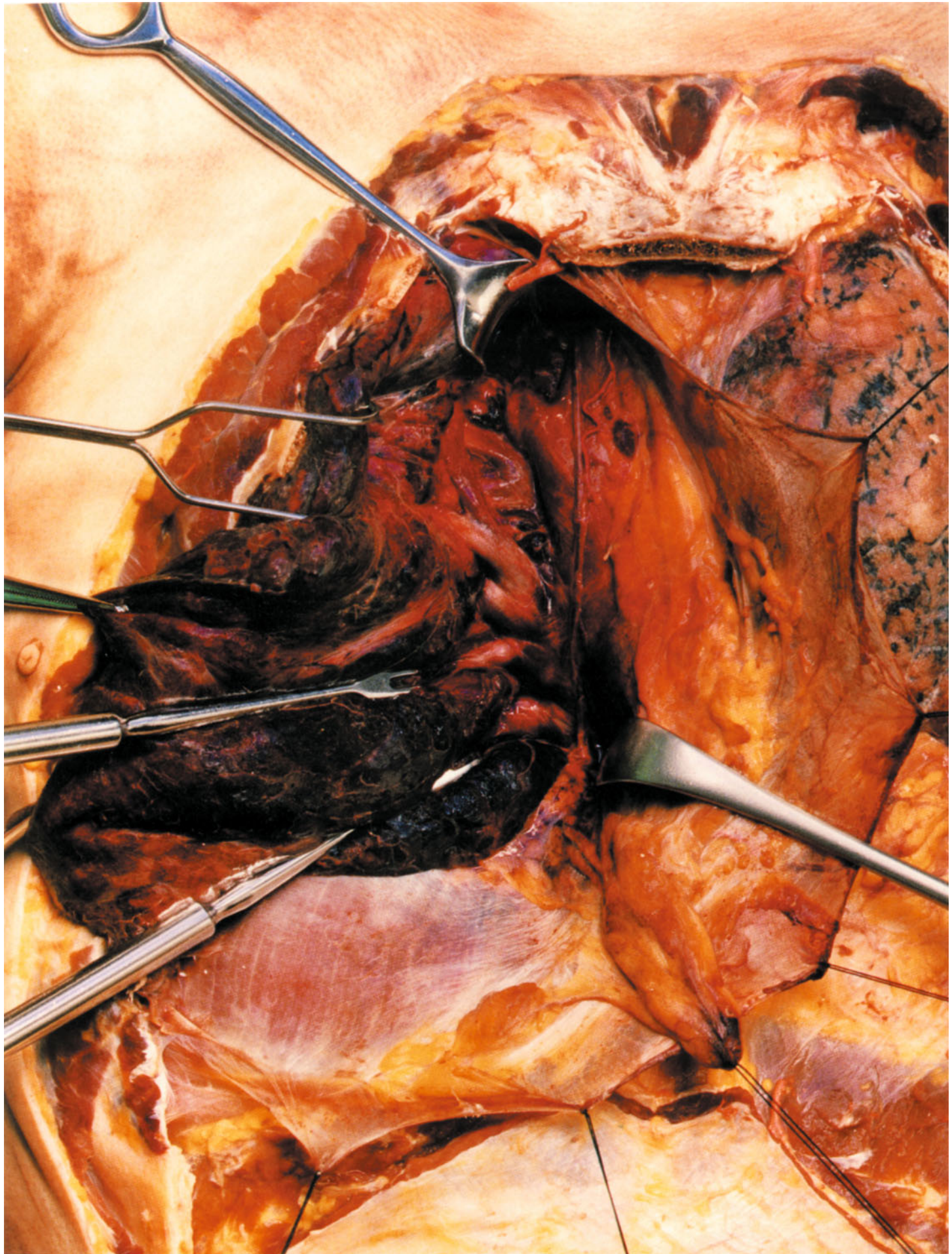


Figure 100**Thoracic Cavity 4
Root of the Lung 3
Pulmonary Arteries and Bronchi
Lymph Nodes**

Greater isolation of the pulmonary vessels has exposed the **right bronchus** with the origin of the **upper lobe bronchus**, visible behind the **pulmonary artery** at the upper border of the lung root.

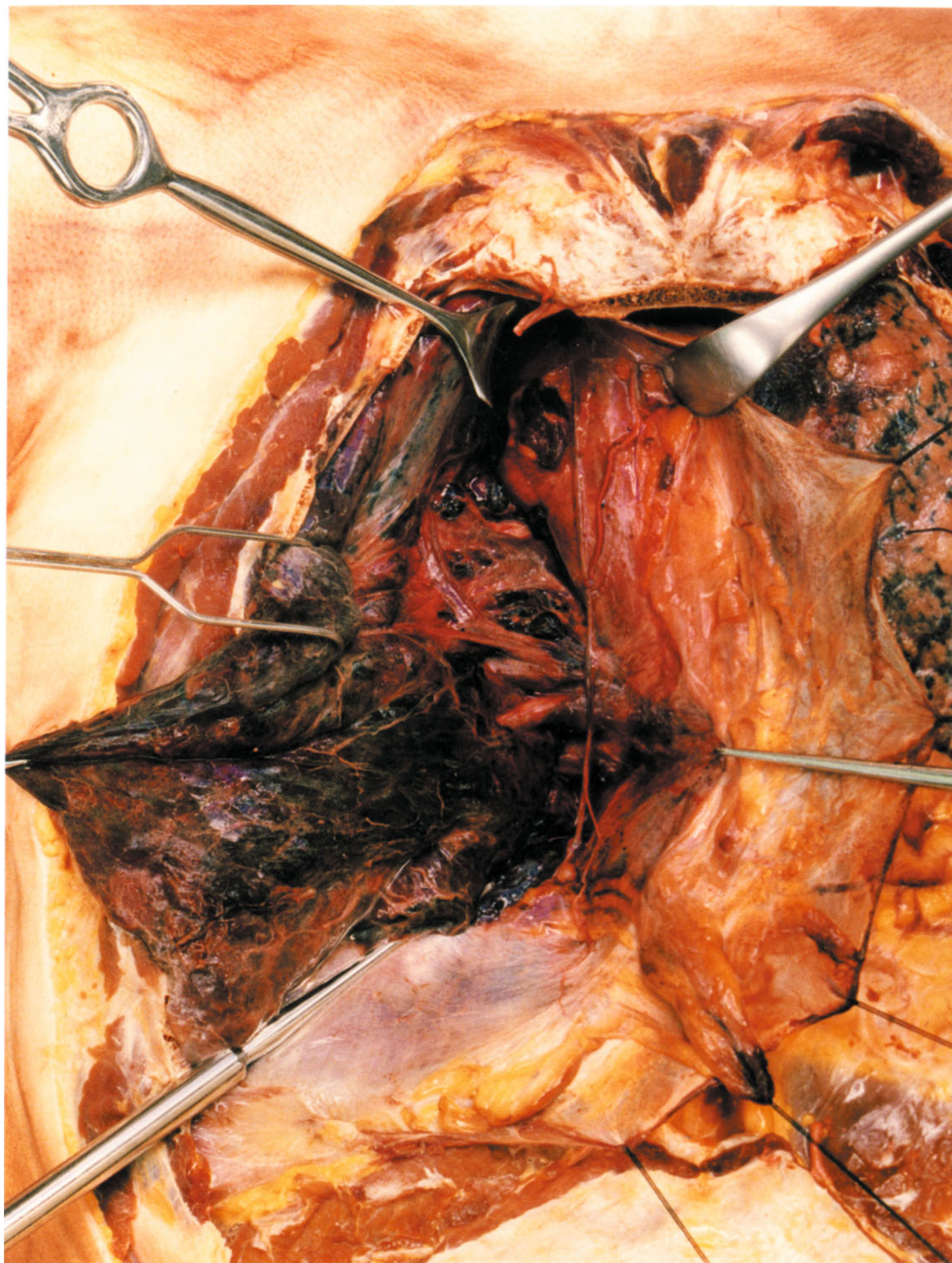
In front of the **upper lobe bronchus**, the **right pulmonary artery** gives off a large branch to the upper lobe called the **anterior trunk** of the right pulmonary artery. This trunk usually supplies the **anterior segment** and **apical segment**. Rarely, it trifurcates and supplies all three segments of the upper lobe.

The **main trunk** of the vessel crosses in front of the bronchus and then accompanies the main bronchus on its lateral side. This is called the **interlobar part** of the vessel because it runs between the lobes and is directly accessible from the **oblique fissure**. It gives rise to all the segmental arteries for the middle and lower lobes as well as the “ascending arteries” that supply the segments or subsegments of the upper lobe not yet supplied by the anterior trunk.

Several **superior tracheobronchial lymph nodes** are visible above the right bronchus. One group of these nodes lies next to the trachea behind the **phrenic nerve**.

The **inferior tracheobronchial lymph nodes** are visible below the pulmonary artery. These nodes form a chain that continues across the **tracheal bifurcation** to the opposite side, passing behind the **pericardium**.

A strip of **mediastinal pleura** was removed from over the **phrenic nerve** and **pericardiacophrenic artery** down to the diaphragm, exposing the **superior vena cava**, the terminal part of the **azygos vein**, the **pericardium**, and some additional lymph nodes in the **mediastinum**. The lowest of these **anterior mediastinal lymph nodes** are named according to their location – the **lateral pericardial lymph nodes**.



The **mediastinal surface** of the left lung has been separated and reflected from the **mediastinum**, which is covered by **mediastinal pleura**. This exposes the anterior aspect of the **lung root**, over which the **parietal pleura** becomes continuous with the **visceral pleura**.

The interpulmonary part of the **parietal pleura**, the **mediastinal pleura**, covers the **pericardium** and, upon reaching the diaphragm, unites with the **diaphragmatic pleura** in the sagittally oriented **phrenicomedial recess**.

The space between the pericardium and pleura in well-nourished individuals contains large fat deposits that accompany the **phrenic nerve** to the diaphragm and connect there with a fat lobule that extends anteriorly into the **phrenicomedial recess**.

At the upper end of the pericardium, the subpleural fat extends with the lung root to the pulmonary **hilum** and connects medially with a fatty layer, the **retrosternal fat pad**, that results from the physiologic involution of the thymus.

The lung is attached to the mediastinum by the massive **lung root**, which contains the bronchi and large vessels. The pleural sheath that invests the lung root extends inferiorly to the diaphragm as a thin, transparent double layer of serous membrane called the **pulmonary ligament**. This structure is attached to the mediastinum just behind the pericardium.

The left lung consists of the **upper lobe** and **lower lobe** separated by the **oblique fissure**. The upper lobe bears the **lingula**, which as usual is separated from the rest of the upper lobe by a small notch, the **culmen** of the left lung.

The **lingula** may be considered a counterpart to the middle lobe of the right lung, and very rarely it may be completely separated from the rest of the lung by a fissure. It consists of an upper and a lower segment, indicated in this specimen by a faint cleft.



The **lung root** and its surroundings vary significantly in **appearance** among different individuals, depending on the amount of **fat** present and the amount of **particulate carbon** inhaled during life. Moreover, **inflammatory processes** can alter the lung so permanently through fibrosis and adhesions that its appearance differs markedly from the “ideal” form (assuming that such a form exists).

These changes are so common that it is difficult to find a “normal-appearing” thorax in older individuals, and it is appropriate to classify them as anatomic features rather than true pathologic changes.

The arrangement of the **lymph nodes** also contributes to the morphologic diversity of this region. This point will be illustrated by several examples that differ markedly from one another.

The **present figure** shows a moderate degree of **anthracosis** accompanied by moderate fibrosis of the lung root and fibrotic expansions radiating over the more superficial vessels.

Due to the relative paucity of fat in this cadaver, the **phrenic nerve** and its accompanying vessels are visible through the **mediastinal pleura** without dissection.

The sagging strip of **costal pleura** marks the location of the **costomediastinal recess**, which joins inferiorly with a lobulated mass of fatty tissue at its junction with the **costodiaphragmatic recess** (and the **phrenicomediastinal recess**, which approaches from behind).

The right lung still occupies the **costomediastinal recess** with its anterior border, while the more collapsed left lung has been retracted away from the **mediastinum** and **diaphragm**.



Figure 103**Thoracic Cavity 5
Root of the Lung 5
Pulmonary Veins
Superior Mediastinum**

The **pleura** posterior to the fold of the **phrenic nerve** has been removed as far as the **hilum**, and the **superior left pulmonary vein** has been dissected free within the lung root. Just above the vein is the bulge of the **left pulmonary artery**, which is adjoined by several anthracotic lymph nodes. The exposed **pericardium** lies anterior to these nodes.

After emerging from the pericardium, the **superior left pulmonary vein** divides at once into three large branches that have been traced a short distance into the slightly fibrotic hilum by sharp dissection.

The upper or **apicoposterior branch** (V1 + 2) divides within the lung parenchyma into an apical branch (V1) and a posterior branch (V2), each of which divides further into an intrasegmental and intersegmental part.

The middle or **anterior branch** (V3) supplies an intrasegmental part to the anterior segment and an **intersegmental part** that runs between the anterior segment (S3) and the upper lingular segment (S4), creating an **intersegmental vein** between the culmen and lingula.

The middle branch ramifies very close to its origin, and its more distal branches may be joined by adjacent venous branches. In this specimen the intrasegmental part of V3 has united with the apicoposterior branch.

The lower or **lingular branch** (V4 + 5) of the superior left pulmonary vein divides into a superior part (V4) and an inferior part (V5) that supply the corresponding lingular segments.

In the exposed **superior mediastinum**, the tagged **hemiazygos vein** is visible on the bulge of the **aortic arch**. This vein runs between the **vagus nerve** and **phrenic nerve** to its termination in the **brachiocephalic vein**.

The anthracotic lymph nodes near the pulmonary artery and aorta belong to the **superior tracheobronchial nodal group**. They lie at a major point of divergence of two drainage pathways that encircle the aorta. The medial pathway leads to the trachea, the lateral pathway to the nodal chain of Most, which drains to the jugulosubclavian venous junction via the **anterior mediastinal trunk**.



Figure 104**Thoracic Cavity 6
Root of the Lung 6
Pulmonary Veins
Lymph Nodes**

This dissection shows a severely **anthracotic** lung like that commonly found in smokers.

The **pleura** has been removed from the **lung root** and adjacent **mediastinum**, and the blackened lymph nodes, already visible through the pleura, have been dissected free. Placed along the **pulmonary artery** and **aorta**, they form a lateral group of **superior tracheobronchial lymph nodes** that connects with the medial tracheobronchial group along the inferior border of the **left pulmonary artery**. They also form a separate drainage pathway lateral to the aorta; this is the nodal chain of Most, which runs upward beneath the pleura and drains into the left jugulosubclavian venous junction via the **anterior mediastinal trunk**.

Although the lung shows severe changes that include fibrotic fusion of the **oblique fissure**, the root of the lung is free of fibrotic changes. As in a normal lung, it was easy to bluntly dissect the lung tissue back along the branches of the **superior left pulmonary vein**. Only two branches were encountered in this specimen: the usual upper **apicoposterior branch** and a lower branch formed by the somewhat rare union of the **anterior branch** with the **lingular branch**. It is more common for the anterior branch to unite with the apicoposterior branch.

The heart, invested by the **pericardium**, has been retracted medially in the area of the left atrial appendage (left auricle) to display the site of emergence of the **superior left pulmonary vein**.

The **mediastinal pleura** left in the **superior mediastinum** has been retracted medially with a hook to expose the top of the **pericardium** and its attachment to the **ascending aorta**. Lateral to this point and anterior to the pericardium-covered pulmonary trunk is a remnant of the **thymus**, which extends to the isolated **phrenic nerve**.

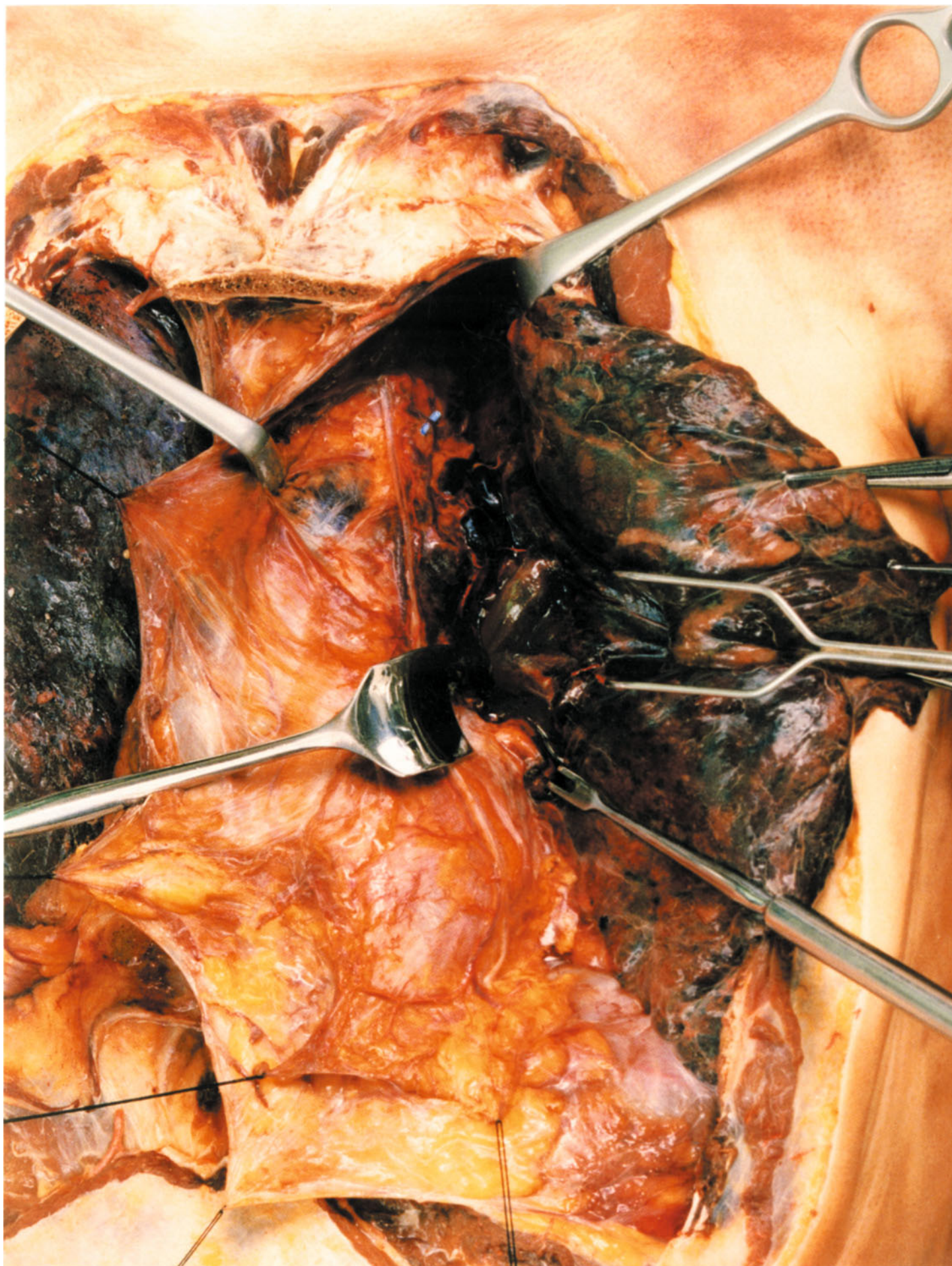


Figure 105**Thoracic Cavity 7
Root of the Lung 7
Pulmonary Artery**

The dissection in the previous figure has been developed further. The lymph nodes have been removed, and the **left pulmonary artery** appears as the most superior structure in the root of the left lung. Slight anterior and medial retraction have been placed on the heart and pericardium just below the left atrial appendage to demonstrate the site of emergence of the pulmonary artery from the **pericardium**.

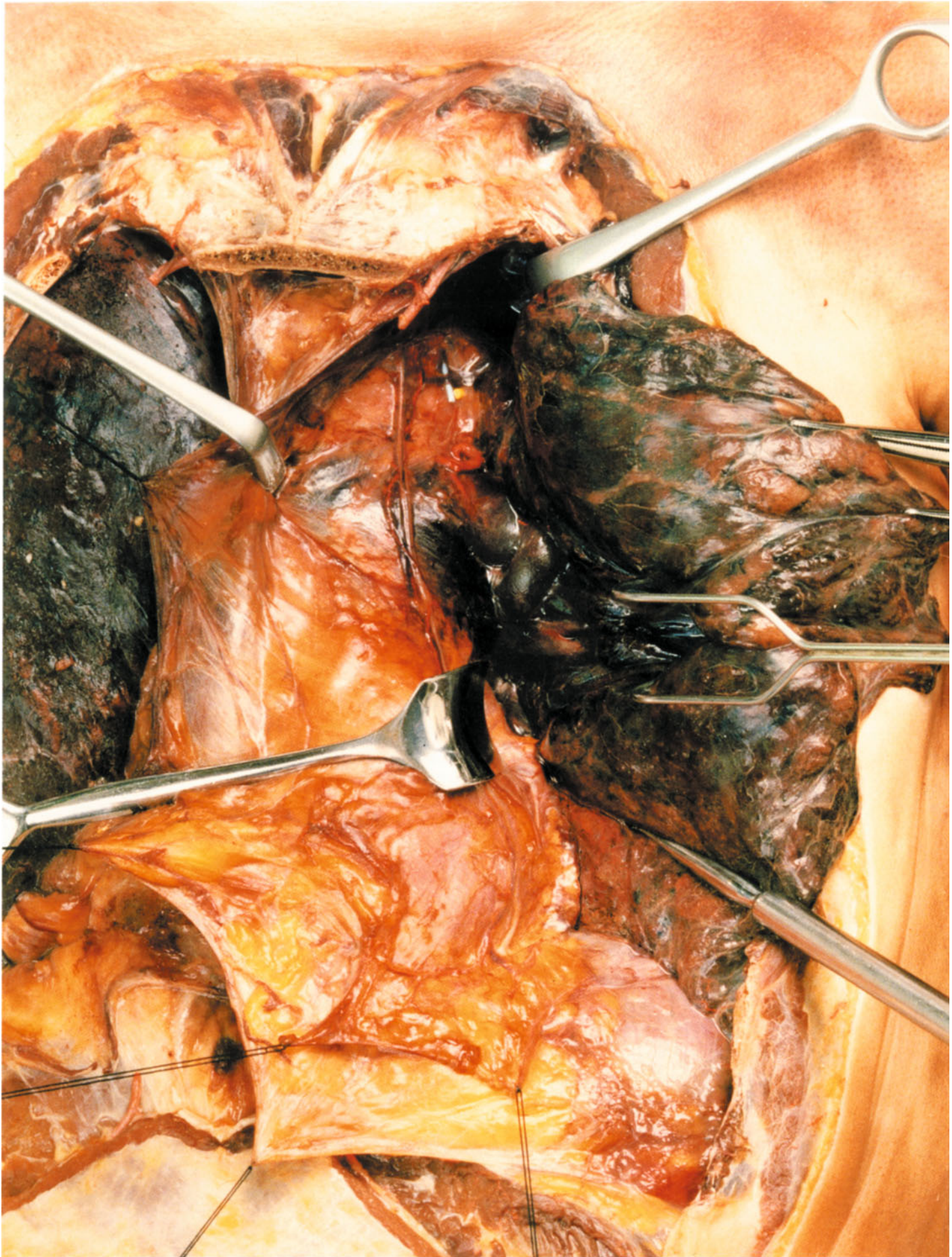
The pale wall of the **left main bronchus** can be seen in the triangular hollow between the pulmonary artery and the superior branch of the superior left pulmonary vein. It is visible because of the anatomic arrangement on the left side, in which the bronchus lies below the artery.

Above the pulmonary artery, the **aortic arch** is visible in the connective tissue of the mediastinum. It is crossed by the **phrenic nerve**, the accompanying **pericardiophrenic artery**, and the **vagus nerve**.

Near the upper border of the aortic arch, the tagged **accessory hemiazygos vein** runs toward its termination in the left brachiocephalic vein, crossing behind the **phrenic nerve** and the **pericardiophrenic artery**, which arises from the internal thoracic artery. Previously the accessory hemiazygos vein crossed over the tagged **vagus nerve**, which descends behind the root of the lung and passes to the esophagus between the lung root and the descending aorta.

The esophagus, lung, and bronchi are supplied by **bronchial arteries**, which often arise separately and in a highly variable pattern from the **aortic arch** and **descending aorta** and also supply the adjacent lymph nodes. The **nodal branches** may attain considerable size.

The **left pulmonary veins** were described in the previous figure.



At this last stage in the dissection of a severely anthracotic lung, we shall briefly review the pathogenesis of **anthracosis**, since the deposition of carbonaceous material is closely related to the anatomy of the lung and its eventual appearance.

The lung normally presents very distinct surface markings that mainly represent the boundaries of the **pulmonary lobules** and are unrelated to pulmonary lymphatic vessels. Carbonaceous particles that are deposited in the **interlobular septa** are carried to these sites by monocyte-derived **alveolar phagocytes** that originally inhabited the surface of the alveolar epithelium. After acquiring a pigment load, phagocytes that are not expelled by coughing withdraw into the **interstitial connective tissue** of the lung. When these cells eventually degenerate and release their pigment, that material is available for ingestion by phagocytic elements in the connective tissue. This process is not confined entirely to the interlobular connective tissue, of course, so a generalized, diffuse discoloration gradually becomes superimposed on the primary lung markings. It is also clear that carbon particles gain access to **lymphatic vessels** via the **interstitial tissue fluid** and become stored in lymph nodes without discoloring the lymphatics themselves. The role played by cellular elements in the lymphatic transport is unknown.

In this figure the **left pulmonary artery** has been retracted upward to better demonstrate the **left main bronchus** with its **bronchial cartilages** and a **bronchial artery**.

Also, the entire remnant of the **thymus** has been freed from the overlying **mediastinal pleura**. It contains a **thymic artery** (a branch of the pericardiophrenic artery), and its interlobular connective tissue contains anthracotic pigment that, as in other organs, must have been transported there by the hematogenous route.

Note also that traction threads have been placed on large fat lobules in the **costomediastinal recess** and **phrenicomediastinal recess**, and that the **musculophrenic artery** (branch of the internal thoracic) anastomoses with the **pericardiophrenic artery** at the mediastinal border of the fat lobule of the phrenicomediastinal recess.



The right and left pulmonary arteries arise from the **pulmonary trunk**, which is contained within the pericardium.

The **right pulmonary artery** emerges behind the pericardium and crosses in front of the main bronchus below the origin of the **right upper lobe bronchus**, which is also called the eparterial bronchus. Thus, the artery lies below the **right main bronchus** within the lung root, and in the hilum it gives off an **anterior trunk** that overlaps the front of the upper lobe bronchus.

The **left pulmonary artery** has quite a different relation to the **left upper lobe bronchus**. This bronchus occupies a hyparterial position, and the artery crosses over the **left main bronchus**. Because of this arrangement, the left pulmonary artery is the most superior structure in the root of the left lung.

The left upper lobe bronchus is the first anterior hyparterial bronchus on the left side and is analogous to the middle lobe bronchus of the right lung. If the **right middle lobe bronchus** were imagined to be transposed upward to form an upper lobe, it would mirror the relationships on the left side. The main trunks of the **pulmonary arteries** continue past these first anterior hyparterial bronchi to the posterolateral side of the bronchial stem.

The **anterior trunk** of the right pulmonary artery distributes segmental arteries to the upper lobe.

The arteries that supply a pulmonary **segment** may be ascending or descending – a distinction based not on the general direction of the vessels but on their origin. **Descending** arteries arise proximal to the corresponding segmental bronchus, while **ascending** arteries arise distal to it. As a result, descending arteries sometimes take an ascending course while ascending arteries may take a descending course.

The **anterior trunk** in this specimen gives off **descending branches** that are supplemented by an **anterior ascending branch**. In the hilum of the left lung, a somewhat rare **superior trunk** is formed by the union of several descending segmental arteries of the upper lobe.

The **lingular segments** in this specimen are supplied by separate superior and inferior ascending branches. The **lingula** may also have a descending supply, either exclusive or supplementing the ascending supply, that arises proximal to the upper lobe bronchus and crosses in front of it.



Figure 108**Posterior Mediastinum 1
Root of the Lung
Pulmonary Sulcus**

The **posterior mediastinum** lies behind a plane passing through the tracheal bifurcation and the posterior wall of the pericardium. It is anterior to the vertebral column from the fourth to the twelfth thoracic vertebrae, and it lies below the posterior part of the **superior mediastinum**. The posterior mediastinum is a region of special anatomic interest owing to the structures that traverse it.

To display the **posterior mediastinum** from the right side, the right lung has been elevated from the **pulmonary sulcus** of the chest cavity and displaced toward the midline. This uncovers a shallow gutter, the **mediastinovertebral recess**, located behind the lung root and pulmonary ligament. It is bounded posteriorly by the azygos vein and, when split open, leads directly to the adjacent **oesophagus**.

In the area between the margin of the **azygos vein** and the **mediastinovertebral recess**, a strip of **parietal pleura** has been resected across the lung root to the superior vena cava, and the lung and **pulmonary ligament** have been retracted forward and medially.

The **esophagus**, which descends behind the lung root, has been slightly elevated from the vertebral column in continuity with surrounding soft tissues to afford a view of the **thoracic duct**.

Some of the pleura behind the lung root has been removed so that a traction thread could be placed on the **vagus nerve** at its junction with the **esophageal plexus** and the trunk of its **bronchial branches**. In the exposed lung root, the **right main bronchus** can be traced to its first division, and a large **bronchial artery** can be seen. Below the bronchus, the inferior **right pulmonary vein** has been dissected free.

The **azygos vein**, filled with clotted blood, passes over the right main bronchus to the **superior vena cava**. The tagged **phrenic nerve** has been tagged as the site where it approaches and becomes applied to the superior vena cava. The phrenic nerve is approached by the **pericardiophrenic artery**, a branch from the **internal thoracic artery**.



Figure 109**Posterior Mediastinum 2
Region of Vertebral Column
Intercostal Spaces**

With the parietal pleura removed from the posterior chest wall, the **vertebral changes** typically found in older individuals are clearly visible. They are a result of vertebral **osteophytosis** (spondylosis deformans), characterized by spurring of the vertebral bodies and protrusion of the **intervertebral disks**. A notable feature is prominence of the inferior vertebral margin, which bears the **inferior costal fossa**; it combines with a corresponding outgrowth on the **head of the rib** to form a small protuberance that impinges laterally on the **sympathetic trunk**.

With the pleura removed, the **intercostal nerves** and their accompanying vessels can be seen traversing the **intercostal spaces** until they disappear in the intercostal muscles. This part of the nerves is covered only by the extremely thin and transparent **endothoracic fascia**, whose removal in the central intercostal space is hardly noticeable. The typical arrangement of the intercostal structures, with the vein uppermost, the artery in the middle and the nerve below, usually develops later in the course of the nerve.

In gaining the intercostal space, the **posterior intercostal arteries** and **veins** cross below the **sympathetic trunk**, and the posterior intercostal veins from the second to fourth intercostal spaces unite to form a common trunk, the **right superior intercostal vein**. This vessel overlaps the **right bronchial artery**, which arises from the fourth intercostal artery. It is a very common variant among the morphologically diverse bronchial arteries of the right side, and as usual it gives off several small branches behind the lung root that are distributed to the esophagus.

Traction threads have been placed to mark the **phrenic nerve** and **vagus nerve**. The **esophagus**, freed of its pleural covering, has been displaced to the left by traction on the **esophageal plexus**, exposing the **thoracic duct** behind it. The dissected posterior aspect of the lung root is basically the same as in the previous figure.



Figure 110**Posterior Mediastinum 3
Root of the Lung
Pulmonary Sulcus**

The left lung has been elevated from the **pulmonary sulcus** of the chest cavity and retracted toward the midline. The **pleura** has been removed from the **mediastinum** and **chest wall** to display the structures of the posterior mediastinum, the lung root, and the pulmonary sulcus.

The **aortic arch** curves over the **root** of the **left lung** much like the **azygos vein** arches over the root of the right lung. Below the aortic arch, the posterior aspect of the left lung root has been dissected free. Its central structure is the **left main bronchus**, which is accompanied by several anthracotic **tracheobronchial lymph nodes**. Ascending from the lateral end of the main bronchus is the **upper lobe bronchus**. The large **left pulmonary artery** overlaps the upper lobe bronchus posteriorly before that vessel, also surrounded by lymph nodes, disappears in the oblique fissure of the lung.

Below the **lower lobe bronchus** is the tagged **left pulmonary vein**. It gives off the tagged **superior branch**, whose **intersegmental part** forms the intersegmental vein between the superior segment and the basal segment group of the lower lobe.

The **vagus nerve** passes behind the lung root shortly after giving off the **recurrent laryngeal nerve**, which loops around the **ligamentum arteriosum** (of BOTALLI). Two traction threads mark the cords of the vagus nerve that unite with the **esophageal plexus** on the visible esophagus.

The **phrenic nerve** initially runs lateral to the **vagus nerve** and then crosses over it by following the **brachiocephalic vein**.

The **endothoracic fascia** has been removed from the upper two intercostal spaces. Medial to that site, on the left side of the esophagus, a segment of the **thoracic duct** has been dissected out of the delicate subpleural connective tissue.

Two **bronchial arteries** arise directly from the **descending aorta**, as is often the case, but the lower of the two arteries has an unusually large caliber.



The pericardium, which encloses the heart and the roots of the great vessels, has a tough outer sac, the **fibrous pericardium**, which appears whitish in areas not covered by other tissues.

The lateral surfaces of the pericardium are covered by **mediastinal pleura**, called also the **pericardial pleura** at these locations. It extends anteriorly to the **costomediastinal recesses**, which leave the intervening pericardium exposed in the inferior interpleural area. This part of the pericardium abuts directly on the anterior chest wall, except for a lower sector in which a thin layer of fat usually intervenes.

Anterior to the upper pericardium is a fatty layer that extends into the superior interpleural area. This **retrosternal fat pad** is still mostly covered by mediastinal pleura and thus lies behind the costomediastinal recess. It results from the physiologic **involution** of the **thymus** with aging and often contains grossly visible **thymic remnants** appearing as a single plate (as in Fig. 106) or as two thin longitudinal cords that correspond to the thymic lobes in children.

Retrosternal fat also extends upward and downward along the **costomediastinal recesses** and **phrenic nerves** in the form of **folds of pleural fat** [*franges sero-graisseuses* (of POIRIER)]. Usually these extensions are grossly indistinguishable from the **thymic fat pad** in older individuals.

The **diaphragmatic part** of the pericardium blends with the **central tendon** of the diaphragm to form the **planum cardiacum**, which slopes slightly downward toward the left side. Only the anterior and lateral borders of the **pericardium** are firmly adherent to the diaphragm, its lateral walls in that area forming the **phrenicomediastinal recess**, which contains prominent folds of fat.

The **planum cardiacum** in children relates inferiorly to the **left lobe** of the **liver**, whose relative growth lag with aging makes room for the fundus of the stomach.

The upper part of the pericardium encloses the great arteries of the heart, and the **fibrous pericardium** is continued along the **ascending aorta** almost to the origin of the **brachiocephalic trunk**, creating a rather high interior **aortic recess** that is especially pronounced on the right side of the aorta.



The **pericardium** has been **opened** to expose the **anterior surface** of the slightly cleared heart and the **intrapericardial** roots of the great **vessels** arising from the ventricles.

The dissector has inserted the right index finger into the **transverse sinus** of the **pericardium** behind the **ascending aorta** and the **pulmonary trunk**. If advanced farther, the finger would reappear to the left of the pulmonary trunk between it and the left atrial appendage.

The two great vessels leave the pericardium through a common aperture, the **arterial portal** (porta arteriarum). Its counterpart, the **venous portal** (porta venarum), consists of several openings in the pericardium that are enclosed in a common sleeve-like reflection of the **serous pericardium** having the shape of a letter “T” (**SAPPEY’S T**).

The channel intervening between the arterial and venous portals is the **transverse pericardial sinus**, which starts on the right between the **superior vena cava** and **ascending aorta** and lies above the horizontal limb of **SAPPEY’S T** that interconnects the **superior pulmonary veins**.

The reflection of serous pericardium on the **ascending aorta** lies well below the origin of the **brachiocephalic trunk**, as the **serous pericardium** tends to lose its apposition to the **fibrous pericardium** in proximity to the vascular openings. But the serous pericardium still has sufficient extension to form a high **aortic recess** in the **pericardial cavity**. This recess is particularly well developed on the right side of the ascending aorta.

The pericardial reflection on the **pulmonary trunk** starts at its bifurcation, so the crotch between the **pulmonary arteries** lies outside the pericardial cavity. The origin of the **ligamentum arteriosum** in that area does not always project into the pericardial cavity.



With the pericardium opened, the clarified heart has been lifted from the **pericardial cavity** and retracted toward the right side. The retractor has opened up the **oblique pericardial sinus**, which lies below the **horizontal limb** of **SAPPEY'S T** and has been filled through the left atrium and the adjacent part of the left ventricle.

Behind the elevated **left atrial appendage**, the collapsed **left pulmonary veins** emerge separately through the pericardium from the left atrium, accompanied posteriorly by the pericardial reflection forming the **horizontal limb** of **SAPPEY'S T**. Its junction with the **vertical limb** of the T, extending from the **inferior vena cava** to the **inferior right pulmonary vein**, can be identified.

Visible above the **left atrial appendage** is a fold arising from the pericardium to the left of the **pulmonary trunk** bifurcation and extending to the **oblique vein** of the **left atrium**. This structure, the **fold of the left vena cava**, is usually present in vestigial form and may contain a left vena cava as a variant. The **transverse pericardial sinus** ends on the left side between this fold and the pulmonary trunk.

The arrangement and relations of the **coronary vessels** on the **diaphragmatic surface** (inferior surface) of the heart are well defined as a result of the clearing process. The most superficial vessels are large **veins** passing to the **coronary sinus**, which lies in the **coronary sulcus** and terminates in the right atrium.

Between the right and left ventricles, the **posterior interventricular vein** (the old middle cardiac vein) passes to the **coronary sinus** while covering most of the **posterior interventricular branch** of the **right coronary artery**. It consistently anastomoses at the cardiac apex with the **anterior interventricular vein** and sometimes forms a common trunk with the **right coronary vein** just before its termination.

The **left coronary vein** passes from the left side to the **coronary sinus** in the connective tissue of the **coronary sulcus** (left in situ). Besides the **anterior interventricular vein** from which it arises, the left coronary vein is joined by several large-caliber veins from the left ventricle, thereby enlarging to a very substantial vessel that has been called the **great cardiac vein**. The **posterior vein of the left ventricle** that joins the coronary vein on the diaphragmatic surface of the heart is duplicated in this specimen.



Figure 113 II **Pericardium 4**
 Pericardial Cavity 3
 Cardiac Vessels

The gross appearance of the heart varies according to the amount of **subepicardial fat** that is present. Views of a very fatty heart are presented to illustrate this principle.

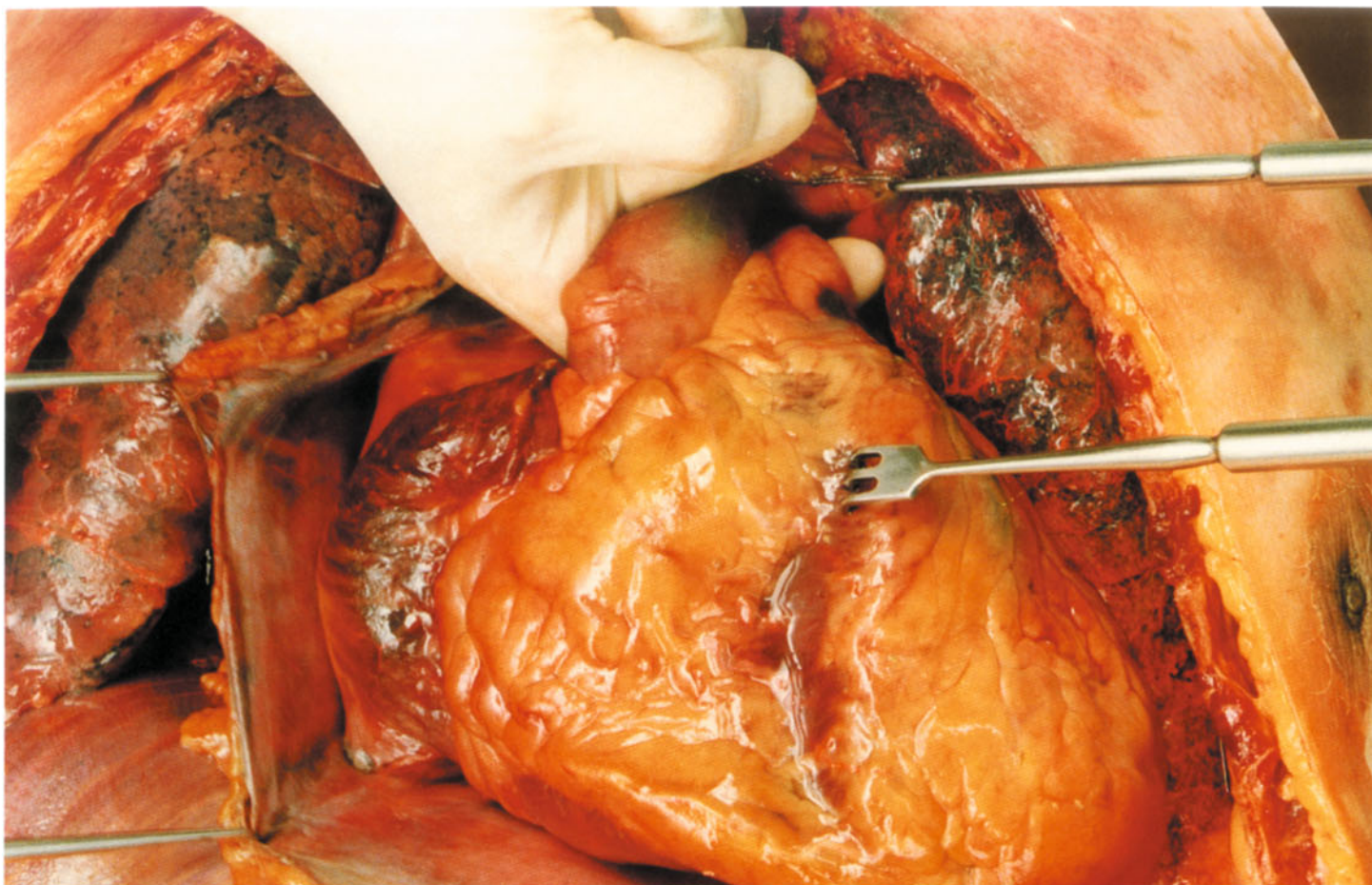
In **Panel A**, the **ascending aorta** and **pulmonary trunk** pass anterior to the index finger, which has been inserted into the **transverse pericardial sinus**. In **Panel B**, the outlet of the **transverse pericardial sinus** is visible between the **pulmonary trunk** and the well-distended **left pulmonary veins**. The **fold of the left vena cava** is barely perceptible in this specimen.

Elevating the cardiac apex from the resected pericardium reveals the opening of a pouch that is interposed between the **inferior left pulmonary vein** and **inferior vena cava** behind the left atrium and is termed the **oblique pericardial sinus**. Because the cardiac chambers are well filled and because of the thick layer of subepicardial fat behind the left atrium, this sinus is opened less widely than in the previous figure.

Analysing the distribution of the **subepicardial fat layer**, we find that it mainly fills the **coronary sulcus** and covers the **anterior surface** of the heart while largely sparing its **inferior surface** and **pulmonary surface**.

As a result, the **posterior veins** of the **left ventricle** (which again are duplicated in this specimen) are clearly visible on the posterior side of the left ventricle. They are accompanied only by narrow strips of subepicardial fat. The subepicardial layer of the **right atrial appendage** contains no fat at all, and that of the **left atrial appendage** contains very little.

The pouch visible between the **pulmonary trunk** and **ascending aorta** in **Panel B**, the **pulmonary recess**, may be compared with the **aortic recess** located to the right of the aorta.



A



B

In this dissection showing the surface anatomy of the heart in situ, the filled chambers of the **right ventricle** and **right atrial appendage** are visible through the myocardium in this slightly cleared specimen.

The branches of the **right coronary artery** that supply the anterior wall of the right ventricle emerge from the **coronary sulcus** between the **right ventricle** and the **right atrium** with its **atrial appendage**. These are the **conal branch**, the **right marginal branch**, and an intervening **anterior right ventricular branch**.

The arteries of the anterior wall of the right ventricle are accompanied by the **anterior veins of the right ventricle** (anterior cardiac veins), which drain directly into the right atrium.

The anterior wall of the right ventricle is also supplied by a visible branch of the **anterior interventricular branch** of the **left coronary artery**. This vessel marks the usual **boundary plane** between the territories of the two coronary arteries, which passes through the anterior papillary muscle of the right ventricle and the posterior papillary muscle of the left ventricle. The **interventricular septum** is usually supplied by adjacent **interventricular branches** that do not arise from the same coronary artery.

The **anterior interventricular branch**, visible between the **left atrial appendage** and the **conus arteriosus** of the **right ventricle**, descends at the boundary between the left and right ventricles as a branch of the **left coronary artery** after first giving off a **circumflex branch** to the **pulmonary surface** of the left ventricle.

The filling of the left ventricle cannot be seen through the wall of that chamber due to its thicker musculature. As a result, the boundary between the right and left ventricles is clearly defined.

The **superior right pulmonary vein** is seen entering the **pericardium** behind and below the junction of the **superior vena cava** with the **right atrium**.



The **epicardium** has been incised around the base of the **right atrial appendage**, allowing the atrial appendage to be reflected from the **conus arteriosus** of the right ventricle and from the **ascending aorta**. This serosa-free area marks the start of the **coronary sulcus**, which contains the initial segment of the **right coronary artery** arising from the **right aortic sinus** (of VALSALVA).

The **aortic sinus** forms a distinct bulge, making it easy to locate the origin of the **right coronary artery**. It does not always occur at the center of the sinus; sometimes the artery arises at the superior border of the sinus or even above it.

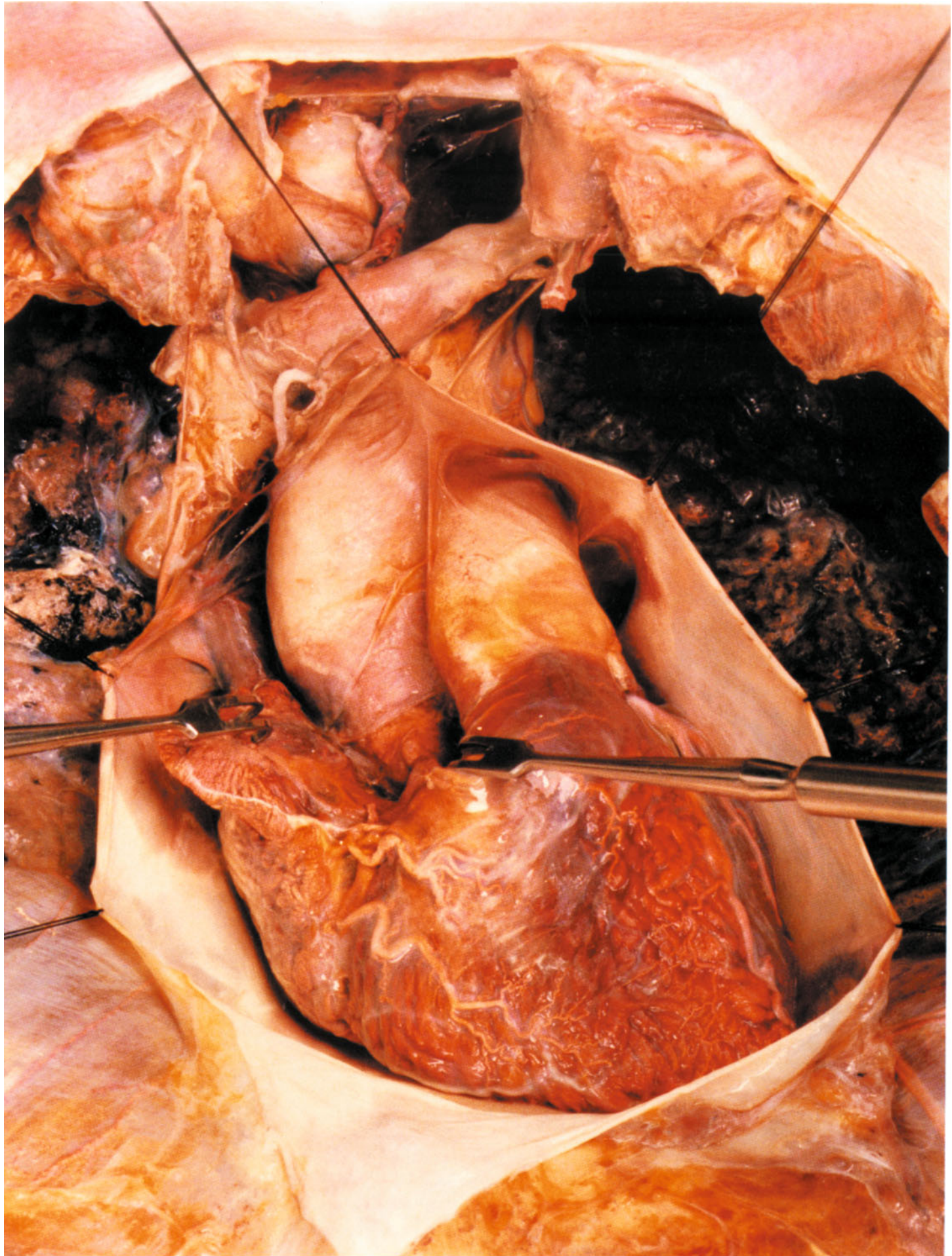
The first branch of the **right coronary artery** is the **conus branch** (conus artery), which anastomoses with an homonymous branch of the **anterior interventricular branch** of the left coronary artery. It is not uncommon for the conus branch to arise separately from the aortic sinus, forming a **third coronary artery**.

The next branch of the **right coronary artery** is the **sinoatrial nodal branch**, which passes to the right atrium on the medial side of the atrial appendage.

The right coronary artery is crossed by **anterior veins** of the **right ventricle**, which drain directly into the right atrium.

The caliber of the **right coronary artery** varies according to the amount of blood it contributes to the posterior wall of the left ventricle. Generally it gives off a **posterior interventricular branch** and a **right posterolateral branch** that supply a variable part of the posterior wall of the left ventricle, as shown in Fig. 113. This type of pattern is called **right dominance**. In the **left dominant** pattern, the **left coronary artery** assumes the function of the **posterior interventricular branch** and supplies all of the interventricular septum.

The branches of the right coronary artery on the anterior surface of the heart were described in Fig. 114. Here we draw attention to the prominent **right marginal vein**, which, like the **anterior veins** of the **right ventricle**, drains directly into the right atrium or passes to the **small cardiac vein**.



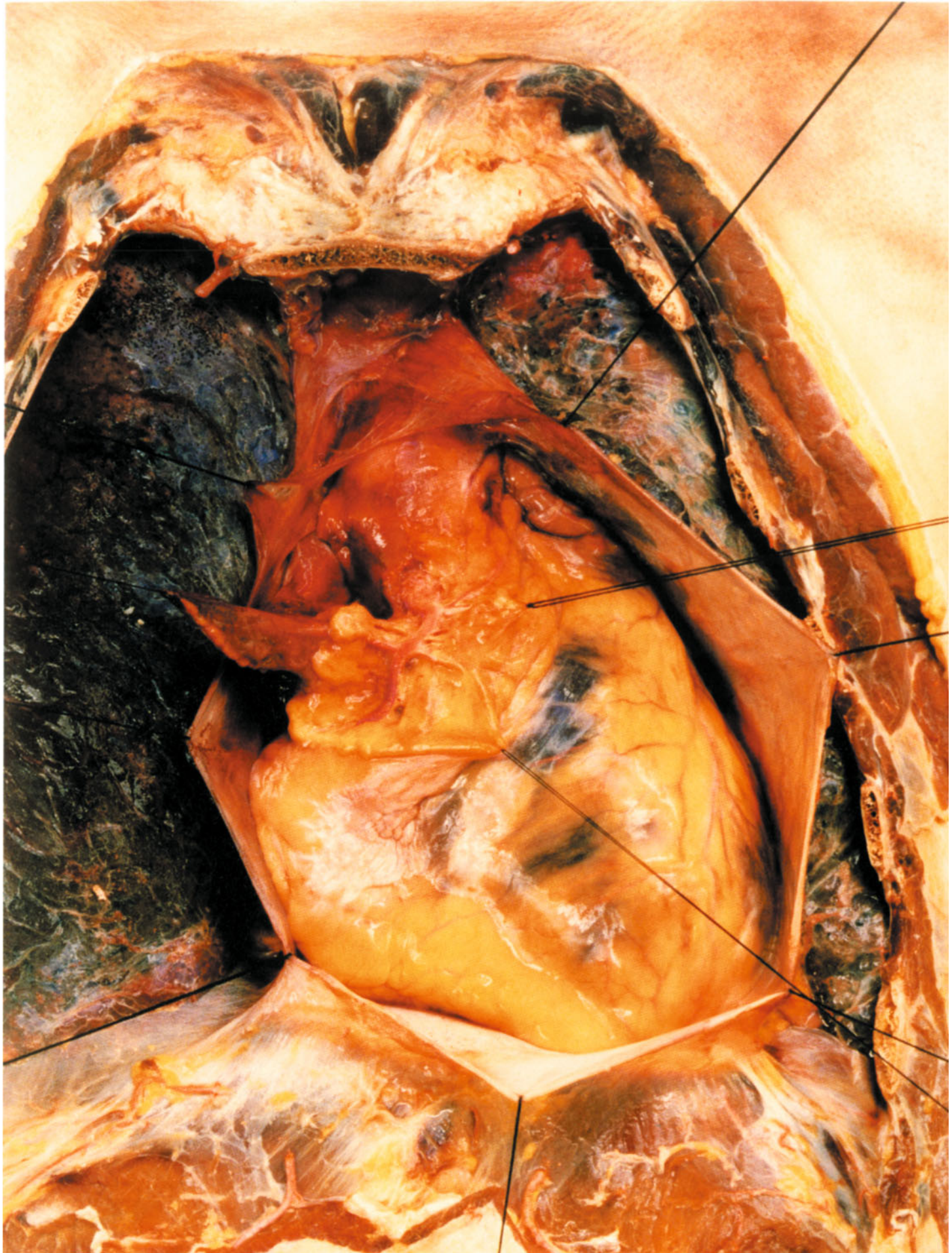
The coronary vessels of the heart in well-nourished individuals are frequently accompanied by thick **subepicardial fat pads** that greatly affect the gross appearance of the heart and make it difficult to locate the vessels. Thus, the dissection in the previous figure has been performed in a fatty heart for purposes of comparison.

Pads of fatty tissue frame the **anterior surface** of the right ventricle, sparing only a modest triangle in which the dark **myocardium** is visible through the transparent **epicardium**. The upper fat pad fills the **coronary sulcus** and follows it back around the fat-covered **right border** to the **inferior surface** of the heart. On the left side of the heart, the fat pad borders the visible myocardial triangle along the **anterior interventricular sulcus**, and several fat pads coalesce in front of **conus arteriosus** and at the **cardiac apex**.

The fat pad on the **anterior interventricular sulcus** covers the **anterior interventricular branch** of the **left coronary artery**. The vessels visible through the epicardium are branches of the **anterior interventricular vein** that pass around the left border of the heart to the **left coronary vein** in the posterior part of the **coronary sulcus**. Thus they are tributaries of the vein that was formerly called the **great cardiac vein**. This conforms to the general rule that larger venous trunks on the heart run superficial to the arterial trunks.

The **epicardium** was incised over the initial part of the **coronary sulcus** on the right side, and the fatty tissue was divided and retracted to expose the initial portion of the **right coronary artery**, which was isolated to its origin from the right **aortic sinus**. The artery overlaps small veins that terminate in the right atrium. Its first branches are the descending **conus branch** and the ascending **sinoatrial nodal branch**.

The short vascular segment visible on the area of myocardium not obscured by fatty tissue is part of the **right ventricular branch** of the **anterior interventricular branch** of the **left coronary artery**.



The heart has been elevated from the **pericardial cavity** and retracted medially at the **apex** to rotate its **left border** and **pulmonary surface** forward.

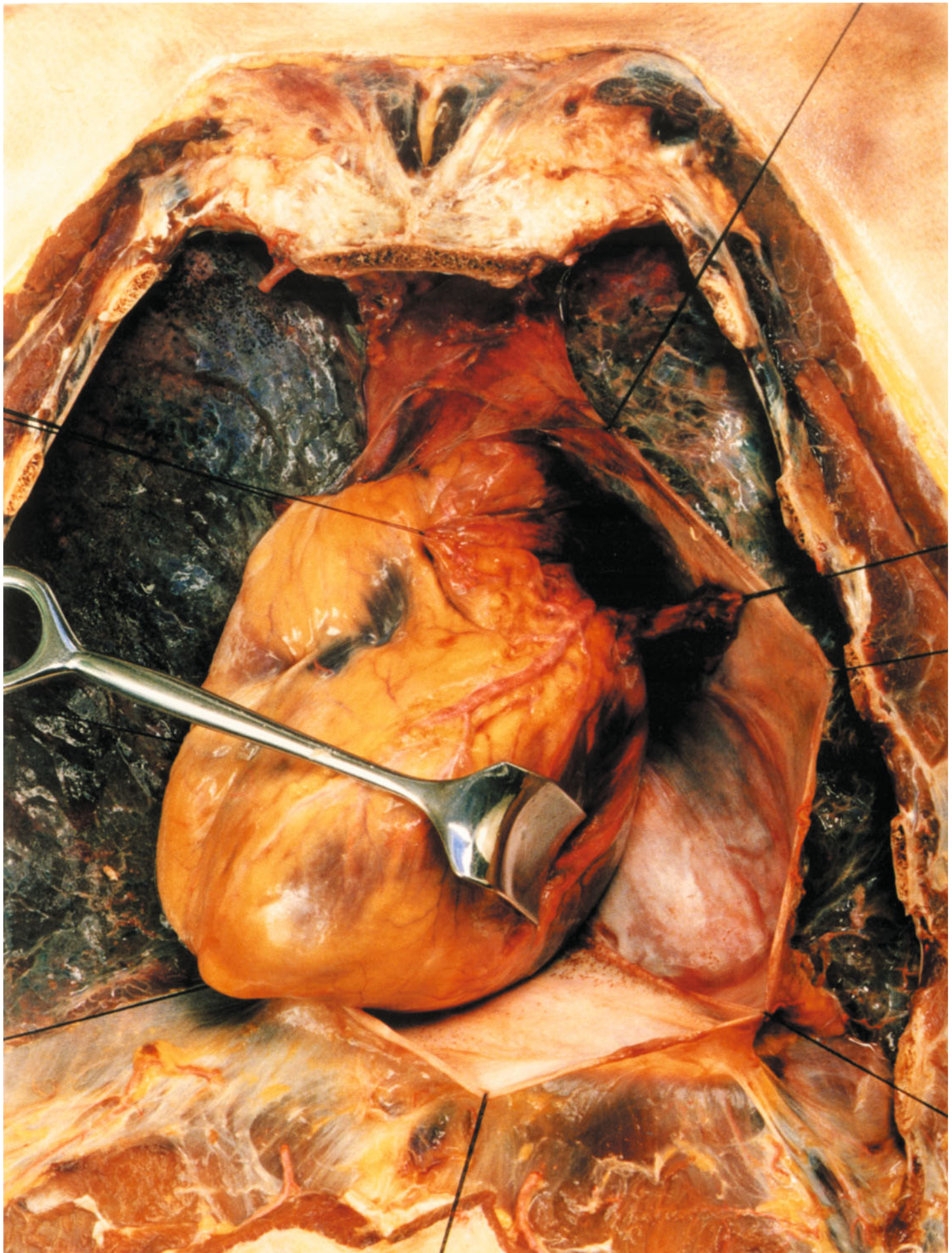
The only visible part of the **left atrium**, which lies behind the ventricles, is the laterally retracted **left atrial appendage** and the barely perceptible superior atrial wall. The **epicardium** and the fatty tissue lateral to the **pulmonary trunk** have been incised and retracted past the terminating **coronary sulcus** to demonstrate the emerging **anterior interventricular branch** of the left coronary artery.

The **circumflex branch** following the coronary sulcus between the left ventricle and the root of the left atrial appendage is concealed by the visible bulge of fatty tissue.

The first branch to arise from the **anterior interventricular branch** of the left coronary artery is the **conus branch**, which anastomoses with the homonymous branch of the right coronary artery. Branches from the lateral side of the vessel are distributed to the left ventricle, the **lateral branch** [diagonal branch] usually being the largest, as it is in this specimen.

The **circumflex branch** supplies a variable region that normally includes only part of the posterior wall of the left ventricle, as in Fig. 106, though it gives off several **posterior left ventricular branches** in that region. Its terminal part, the **atrial branch**, passes to the posterior wall of the left atrium or may continue to the atrioventricular node (of ASCHOFF and TAWARA) as the **atrioventricular nodal branch**, which usually arises from the posterior interventricular branch. This supply pattern is called **right dominance** due to the large contribution from the right coronary artery.

Left dominance is a less common pattern, seen in about one-fourth of the population, in which the **circumflex branch** supplies all of the posterior wall of the left ventricle and also the posterior part of the interventricular septum through a posterior interventricular branch. The caliber of the circumflex branch varies considerably with the extent of its territory. But the **left coronary artery** consistently has the largest diameter, regardless of the supply pattern.



This dissection of an isolated heart shows the interior of the ventricles viewed from the front. The right surface of the **interventricular septum** is visible in this orientation because the septum deviates slightly from the sagittal plane. The **supraventricular crest** arises from the upper part of the interventricular septum. Together with the **septomarginal trabecula** extending from the lower part of the septum to the anterior papillary muscle, it forms the boundaries of an opening that separates the inflow and outflow tracts of the right ventricle.

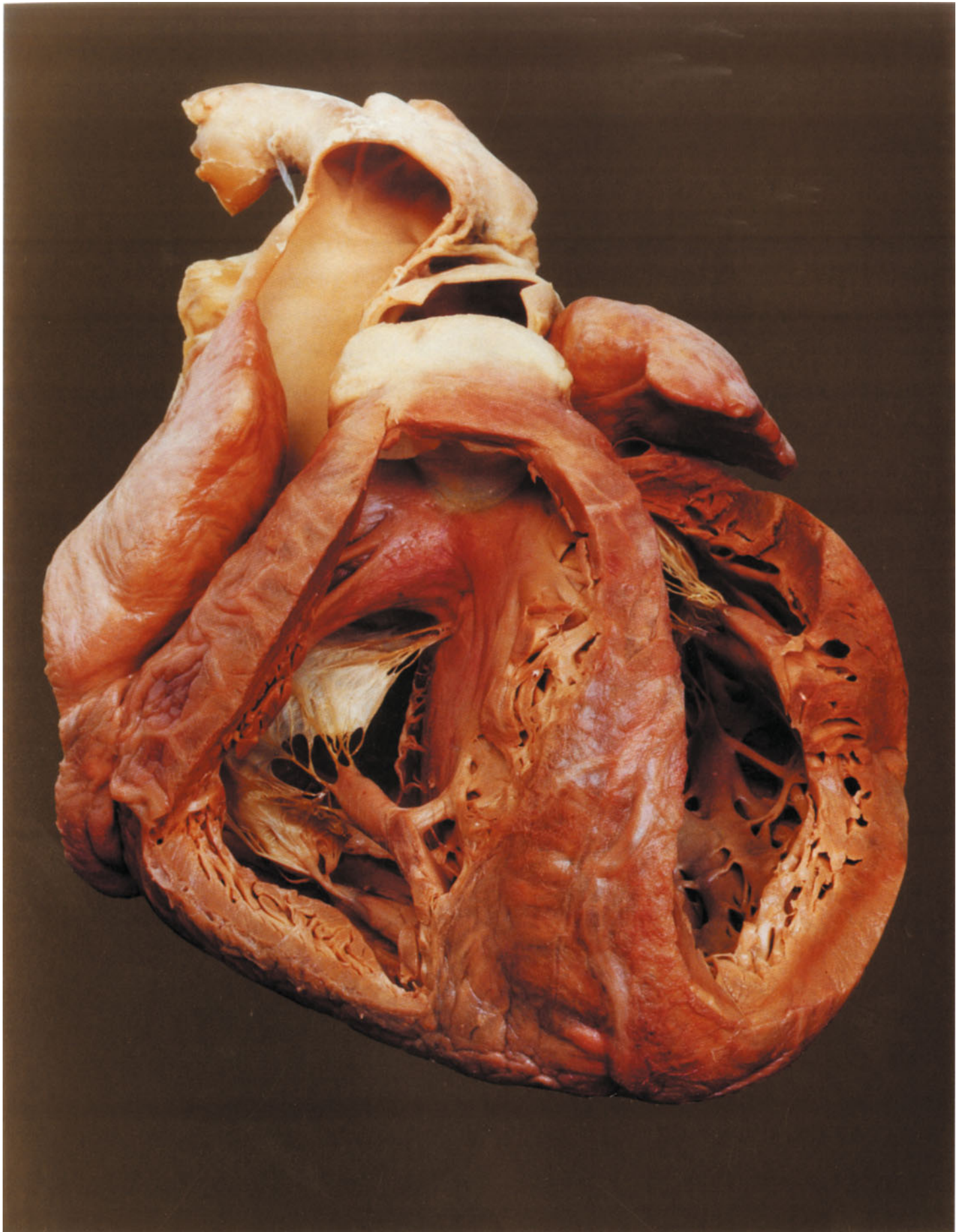
The **inflow tract** starts at the **right atrioventricular orifice** guarded by the **tricuspid valve**. The outflow tract tapers toward the **pulmonary orifice**, forming a conical pouch termed the **conus arteriosus** or **infundibulum**.

The **anterior cusp** of the **tricuspid valve** (right atrioventricular valve) is linked to the **posterior cusp** by a narrow, visible **commissure**. **Chordae tendineae** extend to both cusps from the **anterior papillary muscle**. They attach to the free edge and ventricular surface of the cusps, with fan-shaped chordae passing to the commissures (a pattern characteristic of the chordae tendineae in general).

The **chordae tendineae** arising from the **posterior papillary muscle** between the septum and the posterior wall of the right ventricle attach to the major portion of the **posterior cusp**, while the chordae for the posterior commissural area arise from a relatively common subdivision of the muscle.

The **anteroseptal commissure** between the **anterior cusp** and **septal cusp** is largely obscured by an expansion of **chordae tendineae** from a **septal papillary muscle**. Usually this muscle is very inconspicuous and is supplemented by **accessory septal papillary muscles**. But these muscles may be absent or replaced by chordae tendineae that emerge from the flat surface of the interventricular septum.

The **pulmonary orifice** is guarded by the **pulmonary valve**, whose **left cusp** (valvule) can be seen. This cusp is slightly more posterior than the obscured **right cusp**, and the **pulmonary trunk** above it shows a slight bulge over the **anterior cusp** of the valve.



The heart has been rotated to display the **interventricular septum** edge-on, giving a better view of the interior of both ventricles – particularly the **left ventricle**, which is described below.

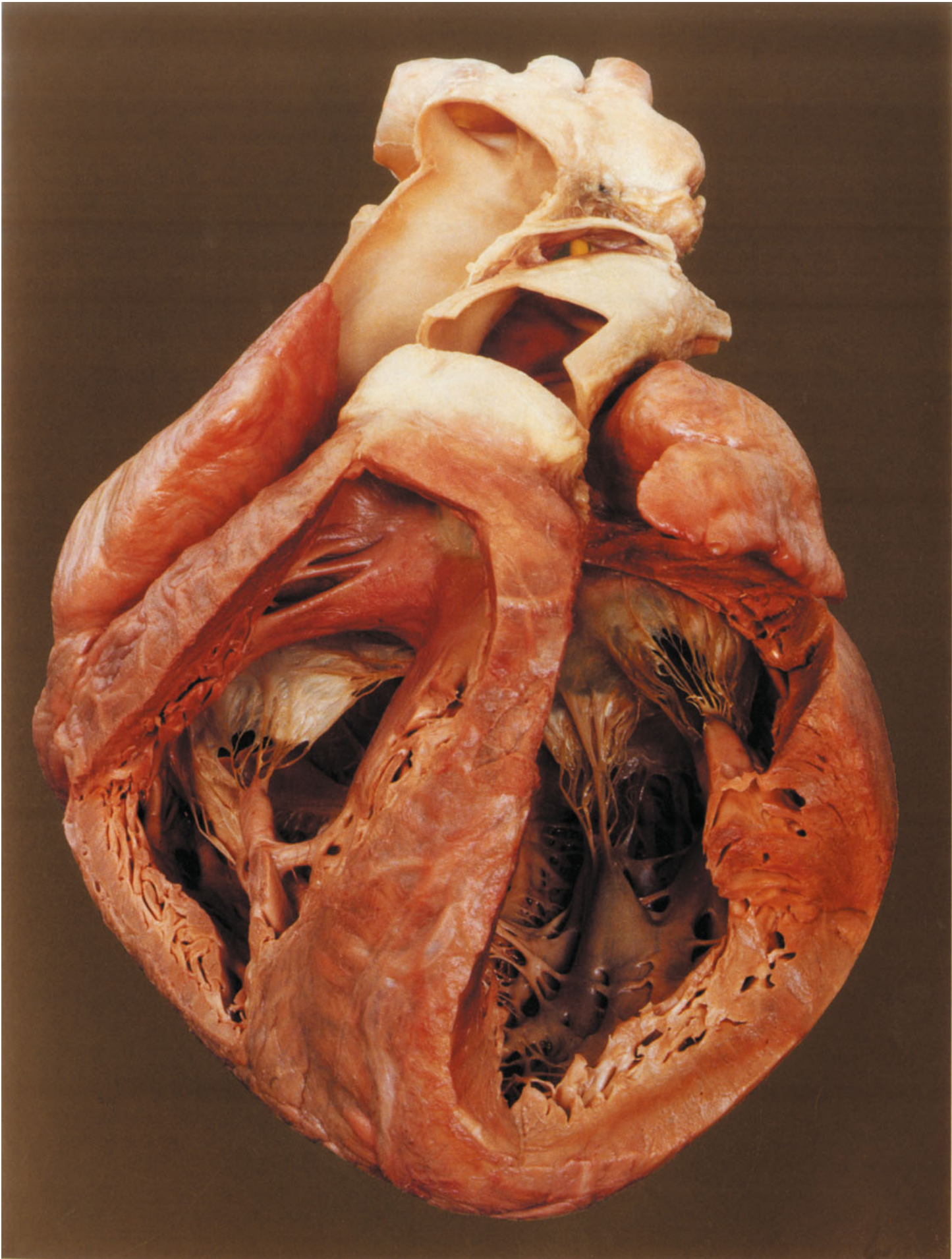
The **inflow tract** of the left ventricle commences at the **left atrioventricular orifice**, which is guarded by the **mitral valve**, known also as the **left atrioventricular valve** or **bicuspid valve**. Like the **tricuspid valve**, the mitral valve is rooted in a fibrous annulus that separates the atrial from the ventricular musculature. The **mitral valve annulus** is incomplete on the septal side, however, where it is closed by the lateral wall of the **aortic fibrous annulus**.

The **aortic fibrous annulus** between the **left cusp** and **posterior cusp** consists of the **left intervalvular septum**, which is continuous on the ventricular side with the fibrous base of the **anterior cusp** of the mitral valve.

The **anterior cusp**, by its attachment to the **aortic fibrous annulus**, separates the inflow and outflow tracts of the left ventricle and is also called the **aortic cusp** because of its association with the aorta. It is unlike other cusps in that its ventricular surface is not ribbed by chordal attachments, so there is no impediment to atrioventricular flow.

The **commissures** between the two cusps are not very deep, but they are positioned opposite two well-developed papillary muscles that distribute their **chordae tendineae** to the adjacent cusps. The **anterior papillary muscle** arises from the lateral wall of the ventricle while the **posterior papillary muscle** is based on the posterior wall close to the **interventricular septum**. Both muscles have broad attachments to the compact ventricular musculature and are adjoined at their origins by stout **trabeculae carneae**.

The **outflow tract** of the left ventricle terminates at the opened **ascending aorta**, through which the orifices of vessels arising from the **aortic arch** can be seen.



These luminal casts of the heart correspond in orientation to the specimen in the previous figure. The lower part of the **interventricular septum** appears edge-on while its upper portion is twisted onto the frontal plane, placing the **conus arteriosus** of the right ventricle in front of the left ventricular outflow tract.

This recapitulates the spiral rotation of the bulbar ridges during embryonic development to achieve separation of the ventricles and interpolate the pulmonary circuit into the systemic circulation.

As a result, the outflow tract of the right ventricle, in the form of the **conus arteriosus**, angles obtusely away from the inflow tract, while the inflow and outflow tracts of the left ventricle remain closely adjacent, separated only by the anterior cusp of the mitral valve.

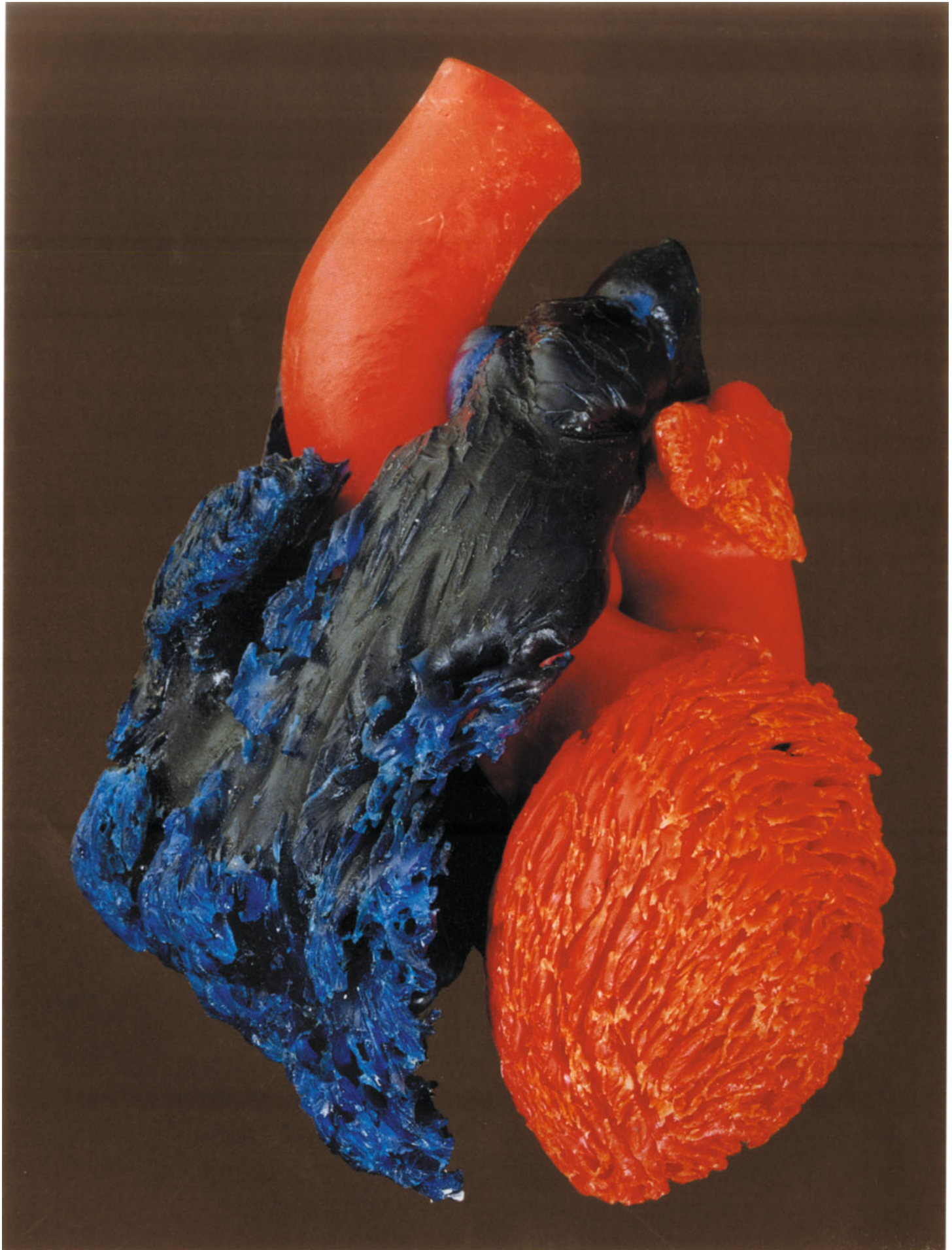
The two **atrial appendages** display the cleftlike impressions made by the **pectinate muscles**. Only the **left atrial appendage** is connected to the smooth wall of the left atrium by a pedunculated base.

The **conus arteriosus** is free of conspicuous **trabeculae carneae**. At the **pulmonary orifice** it bears the **pulmonary valve** with its three outpouching **valve cusps** (semilunar valvules).

At the mostly obscured **junction** of the left ventricular outflow tract with the **aorta**, only the **aortic sinus** of the **left cusp** of the **aortic valve** is visible at the **aortic orifice**. The **coronary sulcus** continues laterally from the aortic sinus.

The **anterior papillary muscle** of the **right ventricle** has left a conspicuous impression in the ventricular wall. The origins of the two papillary muscles of the left ventricle are too posterior to be seen from this aspect.

The **left ventricle** is distinguished by its rounded shape and the regular impressions made by the **trabeculae carneae**, while the **right ventricle** presents a distinctly triangular cross-sectional shape with very irregular trabecular impressions.



Panel A shows the interior of the **right atrium** of a heart set on its apex and viewed from above. This view clearly displays the margins of the **right atrioventricular orifice** with the attachment of the **tricuspid valve**. The three valve cusps are interconnected by **commissures** and are readily identified, owing to their slight prominence, as the **anterior cusp**, **posterior cusp**, and **septal cusp**.

The **anterior cusp** is not directed precisely forward but faces more toward the up-turned **right border** of the heart. The projecting **pectinate muscles** not only appear within the **atrial appendage** but also cover a large adjacent part of the interior of the thin atrial wall. This region is separated from the smooth-walled **sinus venarum** internally by the **crista terminalis** and externally by the **sulcus terminalis**. A relatively thick layer of muscle bundles in continuity with the right cardiac border creates a “spongy” segment of atrial wall that marks the transition from the angular shape of the ventricle to the rounded shape of the atrium.

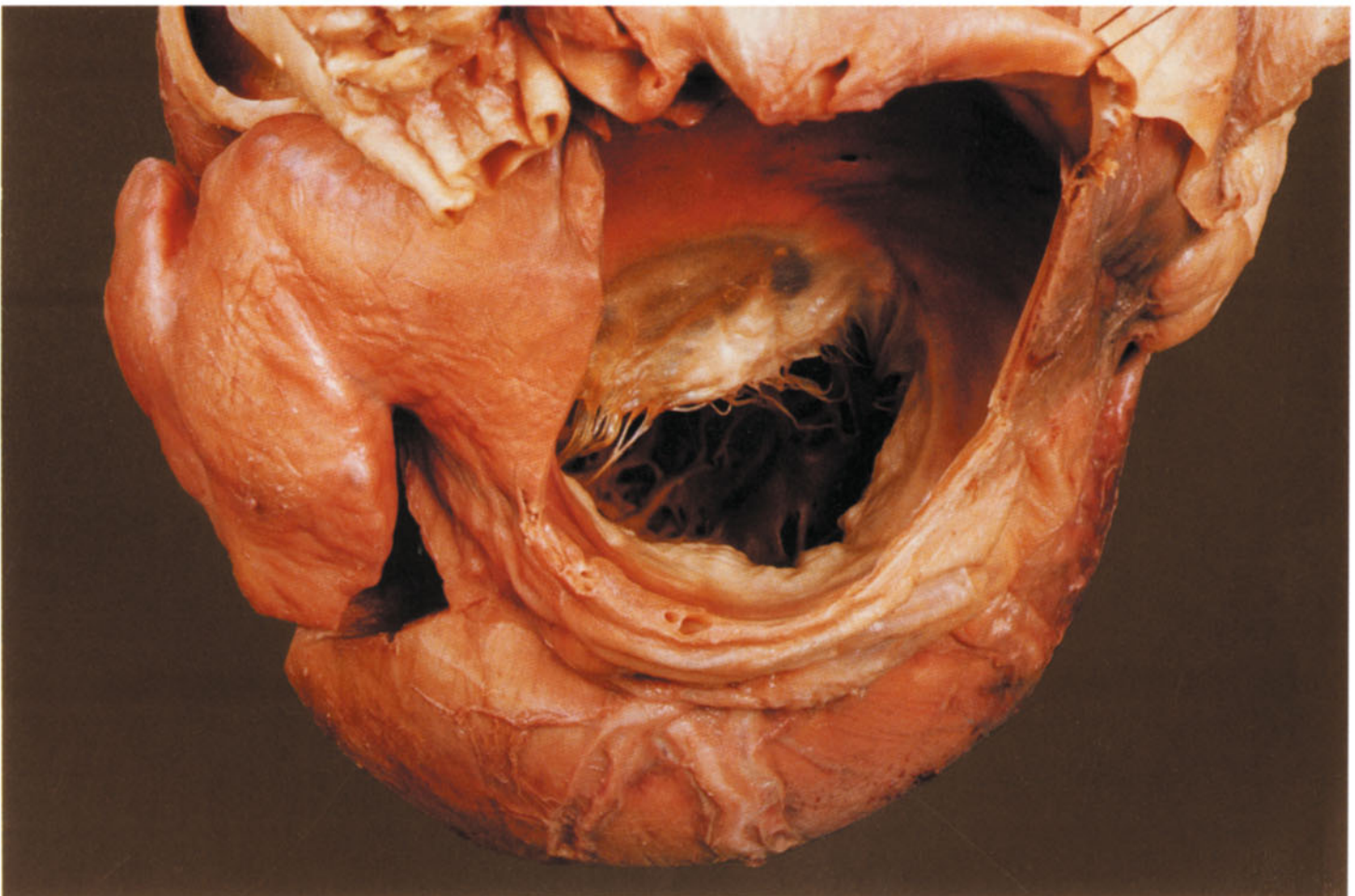
Panel B shows a superior view of the **left atrium** in a heart set on its apex. This view shows the margins of the **left atrioventricular orifice** with the attachment of the **mitral valve**, which consists of an **anterior cusp** and a **posterior cusp**. A **commissural cusp** is interposed at the right commissure, similar to the accessory cusps that occur at other valve commissures.

Topographically, the left atrium extends to the right behind the right atrium, where it receives the **right pulmonary veins**. The **left atrial appendage** (left auricle) is set on the left anterior border of the atrium, just above the coronary sulcus. Unlike its counterpart on the right atrium, the left atrial appendage has a pedunculated attachment to the left atrium, and **pectinate muscles** occur only on its interior surface. The portion of the atrial wall that lies behind the atrial appendage and receives the left pulmonary veins has been resected.

Given the topographic arrangement of the heart, the same views of the atria would be obtained by looking in the direction of the cardiac axis from behind with the subject lying on his or her left side.



A



B

Panel A gives a superior view of a heart resting on its apex, displaying the posterior aspect or **base** of the heart and the opened great arteries of the heart with their semilunar valves.

Part of the **pulmonary trunk** has been resected to demonstrate the **pulmonary valve** with its **anterior cusp**, **right cusp**, and **left cusp**. The valve is closed, so the cusps contact one another at their **lunules** and **nodules**.

The **pulmonary valve** surmounts the opened **conus arteriosus**, where the **pulmonary orifice** lies anterior to the **aortic orifice** with its **aortic valve**. The only visible part of the aortic valve is the lateral attachment of its **right** and **posterior cusps**, with an interior view of the corresponding **aortic sinuses**. Resection of the pulmonary trunk segment has exposed the bulging upper end of the outer surface of the **left aortic sinus**, from which the **left coronary artery** arises and can be traced to the site of its resection.

To the right of the opened **ascending aorta**, the **superior vena cava** descends and connects to the upper border of the **right atrial appendage** at a site coinciding with the subendocardial locus of the **sinoatrial node** (of KEITH-FLACK).

Panel B shows the heart from a lateral and slightly posterior aspect, displaying the terminations of the great veins and the **interatrial septum**. Between the orifices of the superior and inferior venae cavae is the **intervenous tubercle**, below which lies the **fossa ovalis** with its margin, the **limbus**. The **crista terminalis** separates the smooth-walled **sinus venarum** from the anterior part of the **right atrium** that is ridged by **pectinate muscles**. Only the initial and terminal portions of the crista have been preserved.

The **valve of the inferior vena cava** (EUSTACHIAN valve) stretches from the termination of the inferior vena cava to the interatrial septum. This valve, which directed blood flow to the foramen ovale during intrauterine life, and the **valve of the coronary sinus** (THEBESIAN valve) share a common fibrous crus (the tendon of TODARO) that combines with the attachment of the **septal cusp** and the **coronary sinus orifice** to define the boundaries of KOCH's triangle. It contains the subendocardial **atrioventricular node** (of ASCHOFF and TAWARA) of the cardiac conduction system.



A



B

The clavipectoral triangle is a small triangular interval located below the clavicle between the borders of the **pectoralis major** and **deltoid** muscles. Formerly called the **deltoideopectoral triangle** (of MOHRENHEIM), this amuscular interval is very small in individuals with good muscular development, but it forms a marked depression on the skin surface called the **infraclavicular fossa**. It is continuous inferiorly with the **deltoideopectoral sulcus**, which merges with the lateral bicipital sulcus in the arm and creates a pathway for the cephalic vein.

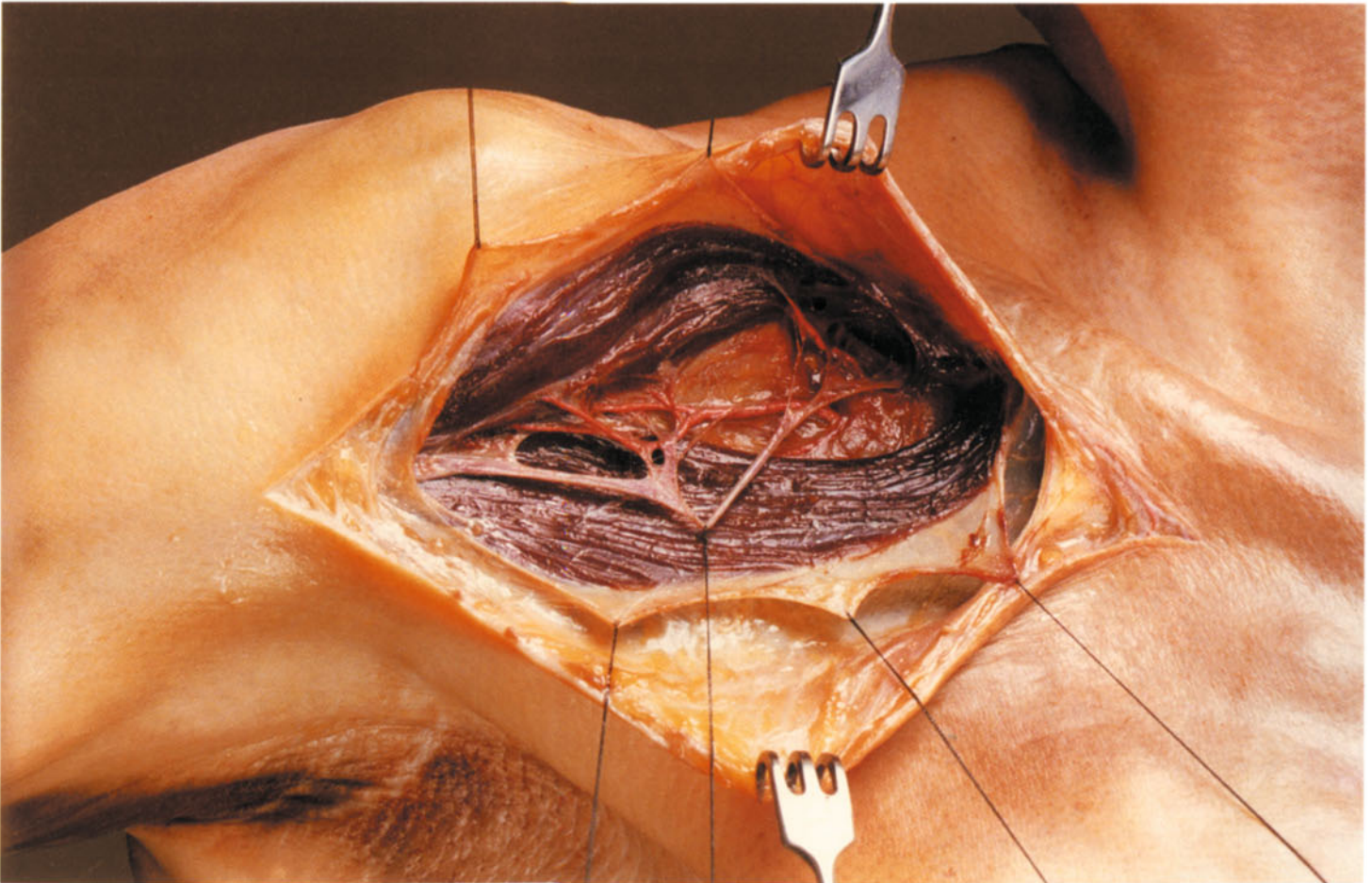
Both muscles are covered by the thin **superficial pectoral fascia**, which also covers the trigone and sulcus. Toward the lateral border of the pectoralis major muscle, the fascia becomes more intimately blended with the **deep layer of the stratum subcutaneum** (see Panel A), which continues posteriorly as the **superficial axillary fascia**.

If the **superficial pectoral fascia** is incised and retracted as in **Panel B**, the **cephalic vein** can be identified within the **deltoideopectoral sulcus**. Usually this vein is more adherent to the **deltoid muscle**. It is accompanied by the **deltoid branch** of the **thoracoacromial artery** and passes with it to the **clavipectoral triangle**, where it pierces the **clavipectoral fascia** before terminating in the **subclavian vein**. Sometimes the vein or one of its branches ascends anterior to the **clavicle** and unites with the veins of the neck.

Before the **cephalic vein** disappears in the **clavipectoral fascia**, it receives a vein that accompanied the **acromial branch** of the **thoracoacromial artery**, just as it usually drains the other branches of the **thoracoacromial vein** or its trunks.



A



B

This anterior dissection of the **pectoralis major muscle** shows a somewhat expanded interval between its **clavicular part** and **sternocostal part**. While both parts generally show a slight interval, usually they are closely approximated with no substantial separation.

The fleshy **clavicular part** of the muscle arises by a short tendon from the sternal half of the **clavicle**, its origin extending medially to the **sternoclavicular joint**. This origin, like the upper portion of the sternocostal part, is composed of thicker muscle fibers than the rest. But the marked thickness of the muscle in the upper part of the anterior axillary fold, proximal to its insertion, results from the convergence of all its fibers toward the upper humerus.

Viewing the **muscle fibers** of the **pectoralis major muscle**, we note that the **clavicular fibers** run the greatest distance to the upper arm and that their broad tendinous insertion into the **crest** of the **greater tubercle** is prolonged to the **deltoid tuberosity**, where the pectoralis tendon unites with the tendon of the deltoid muscle.

Applied to the deep surface of this tendon is a **tendinous sheet** originating from the upper portion of the **sternocostal part** of the pectoralis major muscle. The lower portion of the **sternocostal part** and the **abdominal part** curve back around the lateral border of the muscle and insert at the most proximal site on the **crest** of the **greater tubercle** of the humerus. This layered arrangement creates an intervening pouch that is filled with fat and loose connective tissue and is accessible from the proximal side behind the clavicular part of the muscle.

Thus, the muscle fibers that arise closer to the greater tubercle insert farther distally than the more distant fibers, but this arrangement does not come close to achieving uniform fiber lengths.

The **deltoideopectoral sulcus** transmits a large **cephalic vein**, which is accompanied by the **deltoid branch** of the **thoracoacromial artery**. The fat visible in the **clavipectoral triangle** is not covered by a solid sheet of connective tissue due to the typical cribriform condition of this portion of the **clavipectoral fascia**.



The interval between the **clavicular part** and **sternocostal part** of the **pectoralis major muscle** has been widened to expose the **clavipectoral fascia**, which is pierced by vessels and nerves that supply the muscle.

The **clavipectoral fascia**, while related to the deep surface of the **pectoralis major muscle**, is not a deep pectoral fascia because that plane is occupied by a substantial layer of connective tissue (called simply the **external perimysium** by EISLER) that is firmly adherent to the muscle. Between that layer and the clavipectoral fascia is the **subpectoral space**, which creates a route for the spread of subpectoral inflammatory processes. The **muscle fasciae** are so firmly adherent to the pectoralis major muscle that no such space can exist. (Superficial pectoral fasciitis occurs strictly outside the muscular fascial space.) Both connective tissue layers are fused at the free border of the muscle and thus establish a lateral limit to the subpectoral space.

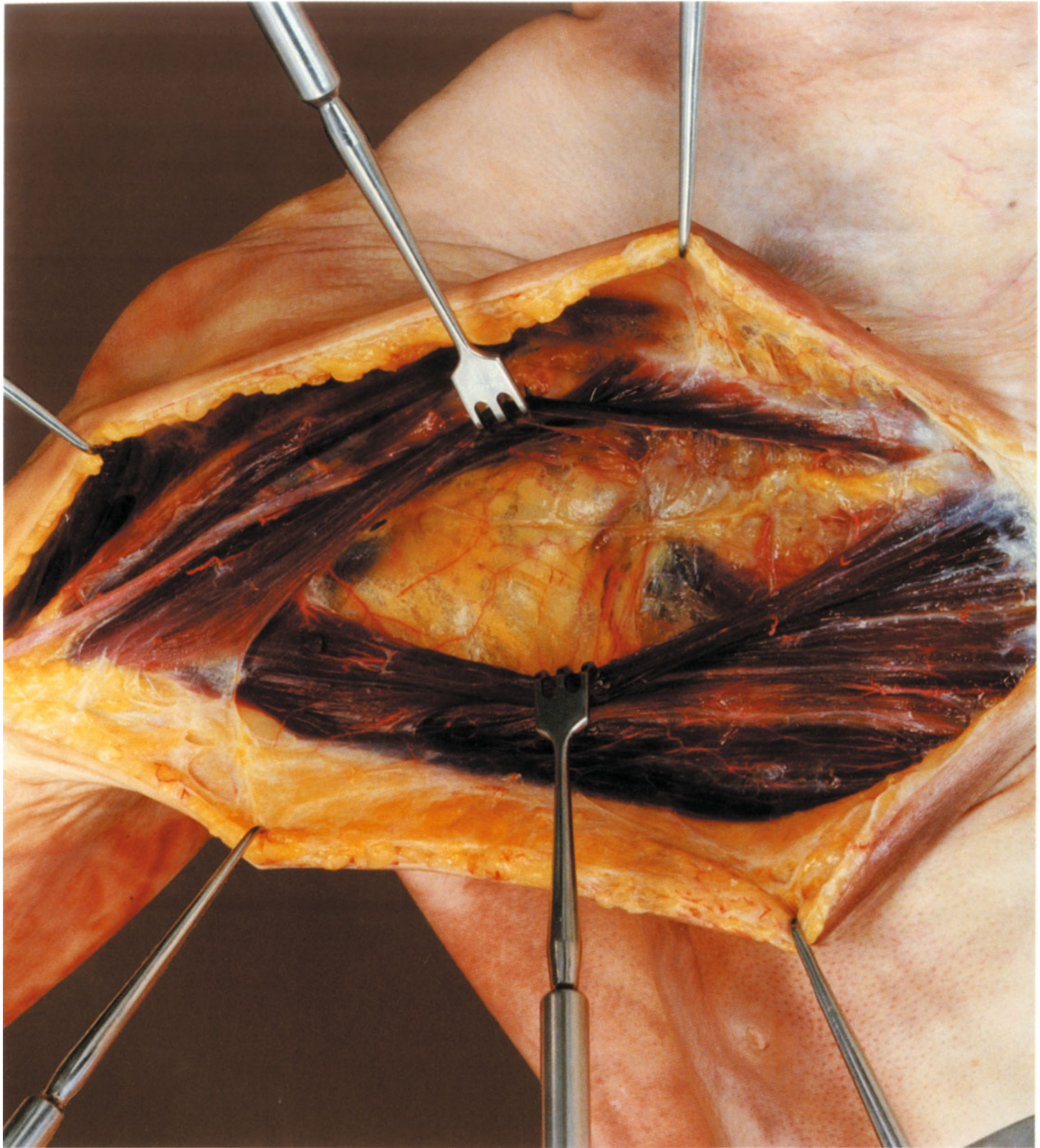
The **clavipectoral fascia** is a relatively independent structure that stretches between the **anterior axillary fold** and the origins of the **pectoralis major muscle** on the chest wall and terminates superiorly at the **coracoclavicular tract**.

The fascia is composed of two layers that ensheath the **pectoralis minor muscle**. The separation of the two layers extends well past the border of the muscle, however, and is maintained by interposed fatty tissue.

The **anterior layer** of the **clavipectoral fascia** is relatively thin. It covers the front of the **pectoralis minor muscle**, which is visible through the fascia where it is not obscured by intervening fat (as in the figure).

The **posterior layer** of the fascia is deep to **pectoralis minor** and covers the front of the **axillary fat pad**. It thus forms the anterior part of the **deep axillary fascia**, which attaches to its posterior part at the **thoracoacromial artery**, i. e., at the medial border of the **pectoralis minor**.

Medial to this site of attachment, and thus between the medial border of **pectoralis minor** and the **coracoclavicular tract**, the neurovascular bundle is covered anteriorly by the **clavipectoral fascia**, which is pierced in this area by neurovascular structures and has the appearance of a **cribriform plate**.



In this dissection the **clavicular part** of the **pectoralis major muscle** has been resected to expand the **clavipectoral triangle** [deltoideopectoral triangle (of MOHRENHEIM)].

In **Panel A**, the anterior layer of the **clavipectoral fascia** was also removed to access and isolate the branches of the **thoracoacromial artery** between the two layers and also the **pectoral nerves**.

The **thoracoacromial artery** divides into its branches at the medial border of the **pectoralis minor muscle**, lateral to the clavipectoral triangle. The nearby branches of the **lateral pectoral nerve** and the **cephalic vein** also pierce the fascia in this area. Between the **deltoïd branch** and **pectoral branch** of the **thoracoacromial artery** is a small fat pad that partially covers the pectoralis minor muscle slip from the third rib due to the overlapping arrangement of the individual muscle slips.

In **Panel B**, all the **clavipectoral fascia** was removed from the triangle between the **pectoralis minor** and **subclavius** muscles so that the dissection of the **thoracoacromial artery**, **pectoral nerves**, and **cephalic vein** could be completed. The **cephalic vein** gives off a large axillary branch anterior to pectoralis minor, then continues in a high arch to the point where the subclavian vein becomes adherent to the subclavian fascia.

The **brachial plexus** and the **axillary artery** and **vein** lie deep within the space between the pectoralis minor and subclavius muscles, which TESTUT calls the **clavipectoral space**. The brachial plexus has been slightly elevated by traction on its **posterior cord**.

The entrance to the **clavipectoral space** is bounded superiorly by a tendinous band arising from the genu of the **coracoid process** and extending to the deep surface of the firm fascia of the **subclavius muscle**. It is called the **coracoclavicular tract**, and its origin adjoins the insertion of the **pectoralis minor muscle** extending from the genu of the **coracoid process** almost to its tip.



A



B

The **clavipectoral triangle** has been enlarged by resecting and reflecting the **clavicular part** of the **pectoralis major muscle**, and the **pectoralis minor muscle** has been resected along with the posterior layer of the **clavipectoral fascia**. This connects the **clavipectoral space** (of TESTUT) with the **axillary space**, which is traversed by the neurovascular bundle of the arm.

A broad stump of the origin of the **pectoralis minor muscle** has been preserved to show the somewhat unusual case of a slip arising from the second rib. The stump at the insertion is mostly tendinous and adjoins the tendinous origin of the **coracobrachialis muscle**, which arises from the tip of the **coracoid process** and is slightly overlapped by the border of the **deltoid muscle**.

A crescent-shaped remnant of the posterior layer of the **clavipectoral fascia** stretches posteriorly from the posterior border of the **coracobrachialis muscle** over the exposed axillary fat pad and behind the **pectoralis major muscle**.

The **deep axillary fascia**, which covers the neurovascular bundle of the arm and unites in a dome-shaped expansion with the posterior layer of the **clavipectoral fascia** behind the **pectoralis minor muscle**, has been completely removed to expose the large nerves and vessels in the **axillary space**.

Below the clavicle, the **subclavius muscle** is visible through its fascia, which is reinforced laterally by the **coracoclavicular tract** and thus has a whitish appearance. The **clavipectoral fascia**, not yet split into its anterior and posterior layers, attaches to the subclavian fascia from below. It has been removed between its two remnants in front of the funnel-shaped attachment of the **subclavian vein** to the subclavian fascia, exposing the adjacent termination of the **cephalic vein** and the **infraclavicular lymph nodes**.

The thin-walled **cephalic vein** is fully collapsed and has been freed from its axillary attachments. The common trunk of the **deltoid** and **acromial branches** of the **thoracoacromial artery** has also been resected.

The union of the **median nerve** roots, derived from the **lateral** and **medial cords** of the **brachial plexus**, is clearly visible in front of the **axillary artery**. Two **lateral pectoral branches** arise from the **lateral cord** and a communicating loop to the **medial pectoral branch** from the **medial cord**.



Figure 128**Axilla 1
Apocrine Sweat Glands**

The **skin** over the **axillary fossa** has been dissected from the subcutaneous tissue and reflected downward. The dark projections on the deep surface of the skin flap are the basal secretory portions of the **axillary apocrine sweat glands**, which are surrounded by a capillary-rich fibrous capsule. The gland lumina permeate the entire dermis via the hair follicles, providing a mechanism for the formation of deep, subdermal **sudoriparous abscesses**.

Figure 129**Axilla 2
Superficial Axillary Fascia**

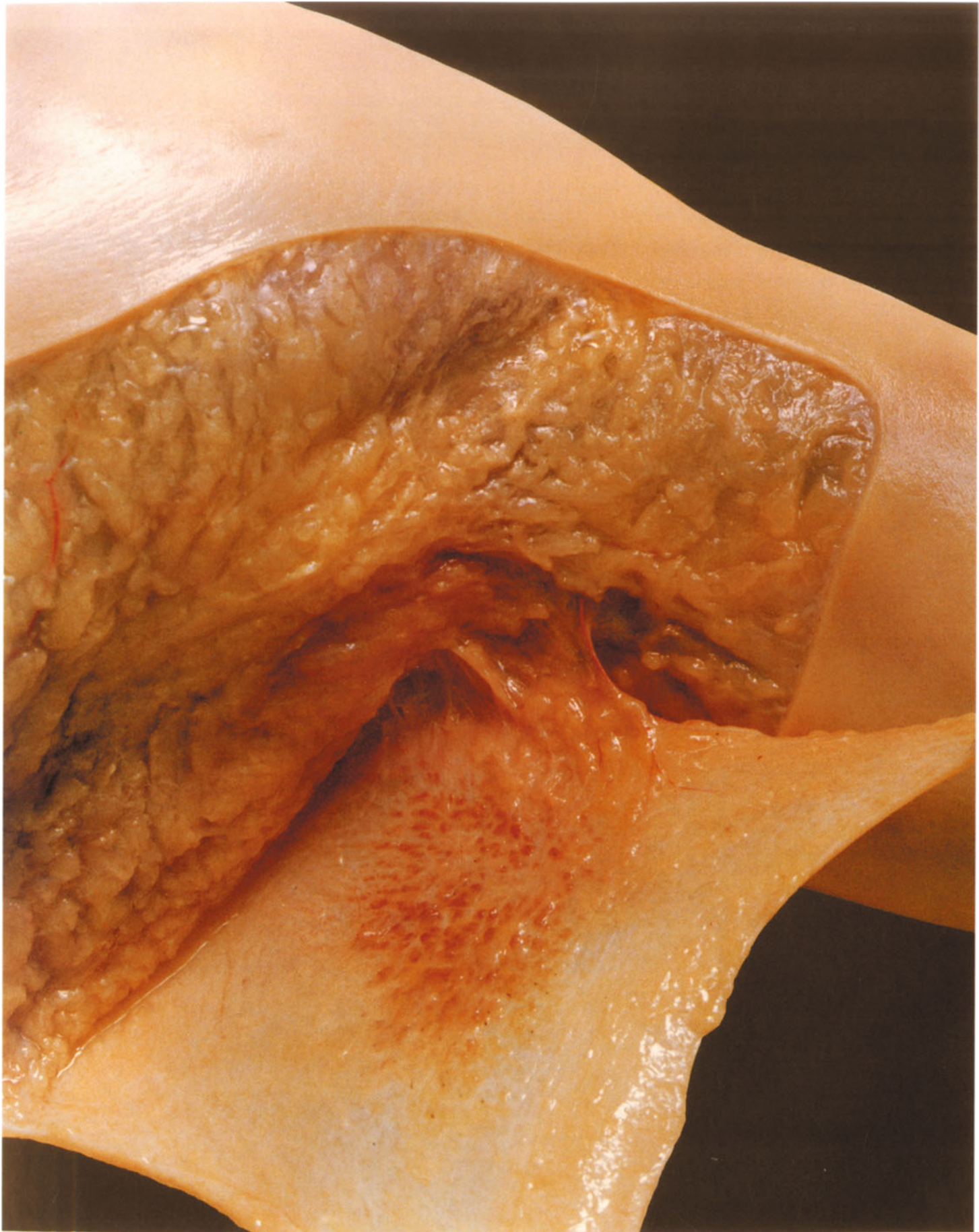
When the **subcutaneous tissue** is removed from the **axillary fossa**, the **deep layer of the stratum subcutaneum** appears in the form of the **superficial axillary fascia**.

The deepest part of this fascia is pierced by vessels and nerves and may even contain portions of embedded lymph nodes. Eisler has termed this “perforated” area of the superficial axillary fascia the **axillary cribriform plate** (lamina cribrosa axillaris). It covers an elliptical aperture bounded by two characteristic arches. One arch is convex toward the upper arm and is called the **fascial brachial arch** (of LANGER). Opposite to it is the **fascial axillary arch** (of LANGER), which has a firmer margin and is more elevated from the chest wall than the brachial arch by the neurovascular bundle of the arm.

The **anterior limbs** of the **arches** interconnect at the posterior border of the **pectoralis major muscle**, where they blend with the lateral border of the **clavipectoral fascia**.

Sometimes the axillary arch is replaced by a **pectoral muscular axillary arch** composed of separate slips of the **pectoralis major muscle** arising from the tendon of **latissimus dorsi muscle**. The **latissimus dorsi muscle** itself may form a muscular axillary arch, and it is not too uncommon for both muscles to contribute fibers to the arch.

The **posterior limbs of the arches** connect at the tendon of the **latissimus dorsi muscle**, the limb of the axillary arch tending more toward the deep surface of the muscle.



In **Panel A**, the **axillary cribriform plate** has been removed to demonstrate the **fascial brachial arch** and **fascial axillary arch** (of LANGER) and several **superficial axillary lymph nodes**. These are identified as **brachial lymph nodes** by their marked enlargement secondary to suppurative processes that typically originate in the hand.

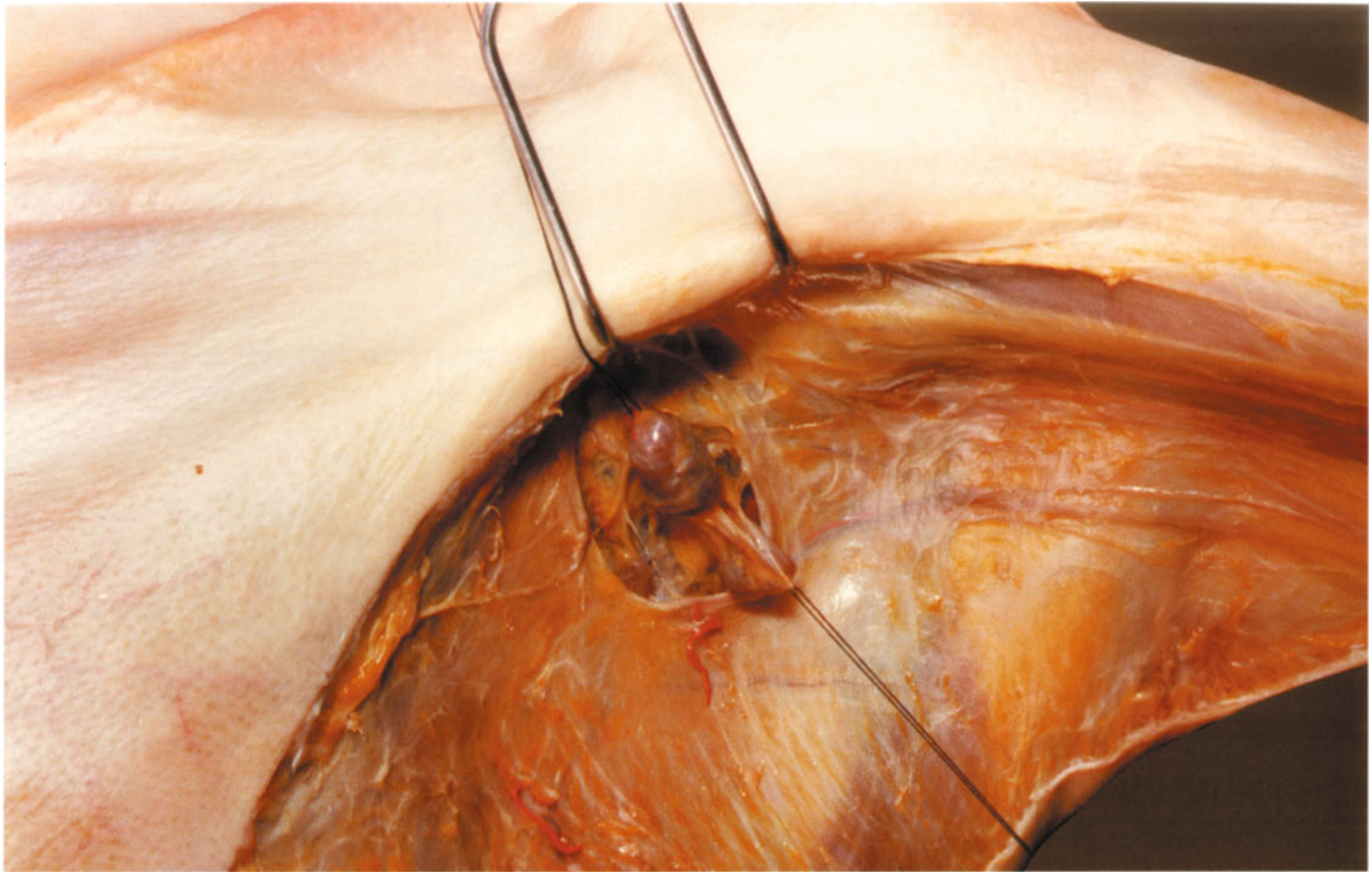
In **Panel B**, the opening in the **superficial axillary fascia** has been greatly enlarged, and traction threads have been placed at the limbs of the brachial and axillary arches to retract the remnants of the **cribriform plate**.

The transition from cribriform plate to solid superficial axillary fascia is gradual, so their separation is an artificial contrivance. But the characteristic arches are always present and vary greatly in their width, as these two dissections illustrate.

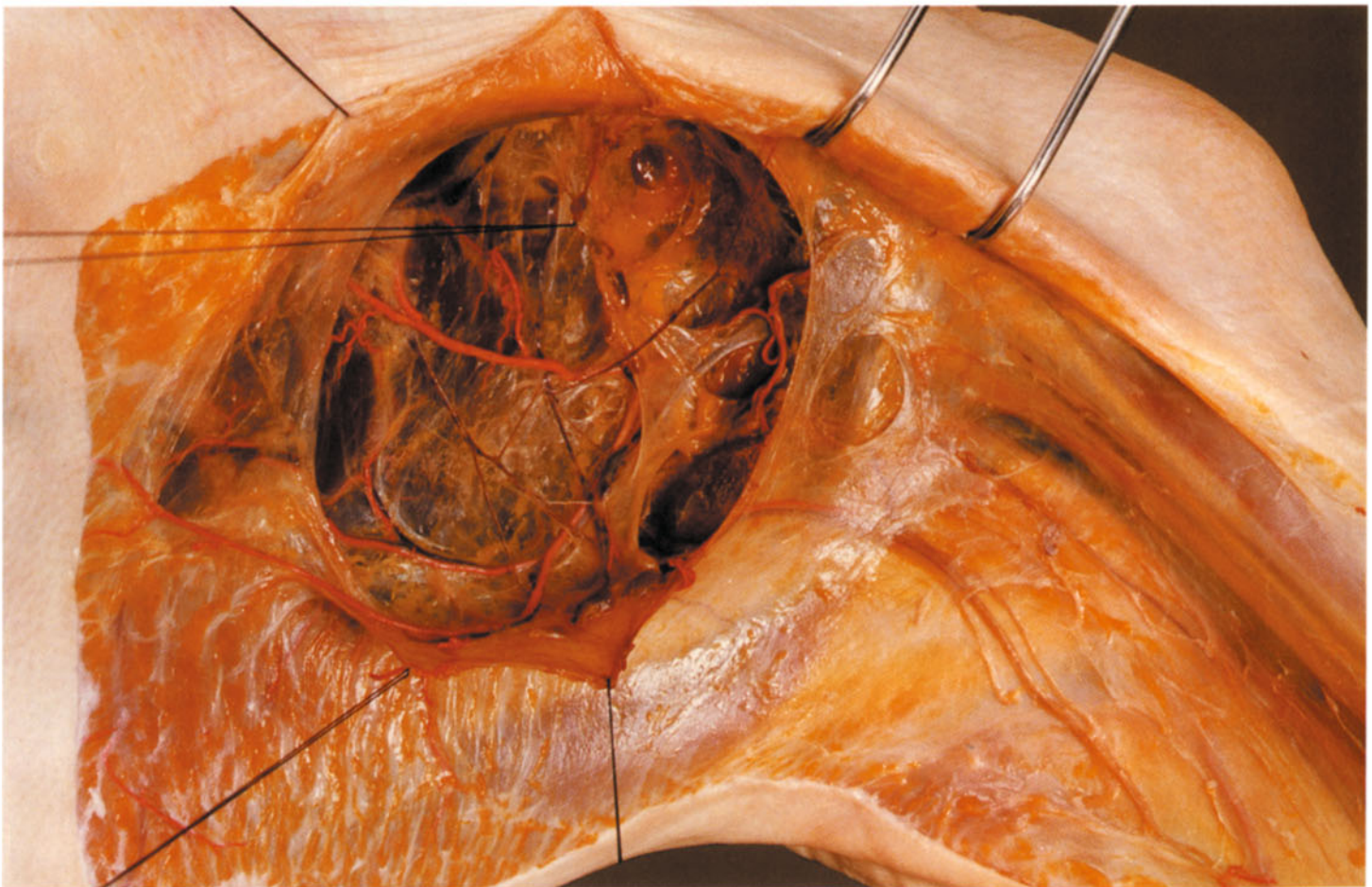
With the axillary fat removed, the expanded opening affords a clear view of the medial and posterior walls of the **axillary space**, which meet in a deep fissure that still contains remnants of connective tissue. The medial wall is formed by the **serratus anterior muscle**, which is covered posteriorly by a thickening fascial layer. The **intercostobrachial nerve** from T2 and T3 emerges from the muscle, and a large branch of the **thoracodorsal artery** runs along its surface to the territory of the **lateral thoracic artery**, which the thoracodorsal artery may sometimes replace.

Several deeper lymph nodes identified as **central lymph nodes** of the axillary nodal group can be seen on and within fascia-like sheets of connective tissue. An **alar thoracic branch** arising from the subscapular artery or directly from the **axillary artery** passes to the greatly enlarged superficial lymph node to supply it and other nodes.

An anastomotic branch passes from the brachial plexus to the intercostobrachial nerve.



A



B

With the axilla viewed from the side and from below, the **axillary cribriform plate** (of EISLER) has been widely removed to expose the **axillary space**. This space contains the axillary fat pad, and all of its walls are lined with fascia.

Part of the **axillary fat pad** has been bluntly dissected from the fascial walls to show the bulge of the **neurovascular bundle** in the axilla. This structure continues in the long axis of the arm and is covered by the **deep axillary fascia**. Several adjoining lymph nodes collect lymph from the arm and are therefore called the **brachial lymph nodes**.

A traction thread has been placed on an **intercostobrachial nerve** through the overlying fat pad. The superficial layer of the fat pad is traversed by the **costoaxillary vein** (of BRAUNE), which consistently drains the intercostal veins. This vein unites with the **lateral thoracic vein** outside the axillary space and sometimes forms a **thoracoepigastric vein** via its large connection with the superficial epigastric vein.

The fat pad contains most of the axillary lymph nodes, but even the most superficial of these nodes are very difficult to identify without dissection.

The **pectoralis major muscle**, behind which the limbs of the **fascial axillary** and **brachial arches** blend with the **clavipectoral fascia**, has been retracted to show the apex of the pyramid-shaped axillary cavity, which is bounded by the lateral chest wall, the **subscapularis muscle**, and the **pectoralis minor muscle**. Very little of the lateral chest wall can be seen from this aspect, because the viewing angle is almost parallel to its receding surface.

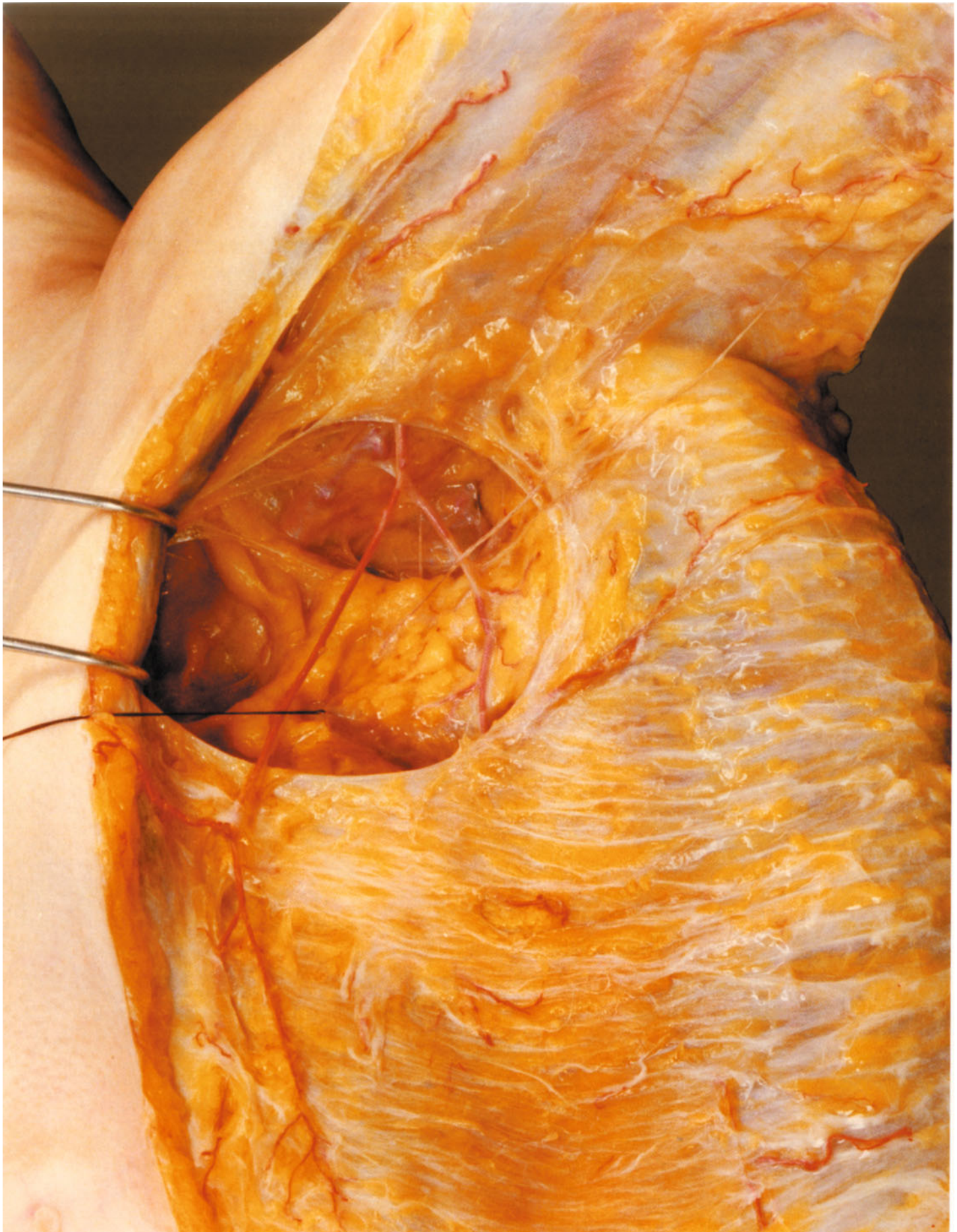


Figure 131**Axilla 4
Axillary Space 2
Axillary Lymph Nodes**

The dissection of the **axillary space** in the previous figure is viewed from a more lateral angle, revealing more of the lateral chest wall, and most of the **axillary fat pad** has been removed to expose the embedded lymph nodes.

According to GROSSMAN and GROHSE, the **axillary lymph nodes** number from 8 to more than 40. The present specimen is near the lower limit of this range.

Just anterior to the **intercostobrachial nerve** is a large lymph node accompanied by two smaller nodes. They belong to the group of **central lymph nodes**, which are a collecting and relay station for the other groups of axillary nodes.

Below the emerging **intercostobrachial nerve** at the third slip of the **serratus anterior muscle**, a **pectoral lymph node** called the **node of Sorgius** lies directly on the chest wall at the border of the retracted **pectoralis major muscle**. It may be replaced by a small group of lymph nodes, a suggestion of which is present in this specimen. Several other, smaller **pectoral lymph nodes** are seen closer to the retracted edge of the **pectoralis major muscle**.

The **subscapular lymph nodes** lie between the **subscapularis** and **teres major** muscles, in the area where the **subscapular artery** divides into branches. These nodes are traversed by the lower branch of the **intercostobrachial nerve**, and the highest medial nodes of the group lie adjacent to the central lymph nodes.

The **brachial lymph nodes** have been left in contact with the **deep axillary fascia**.

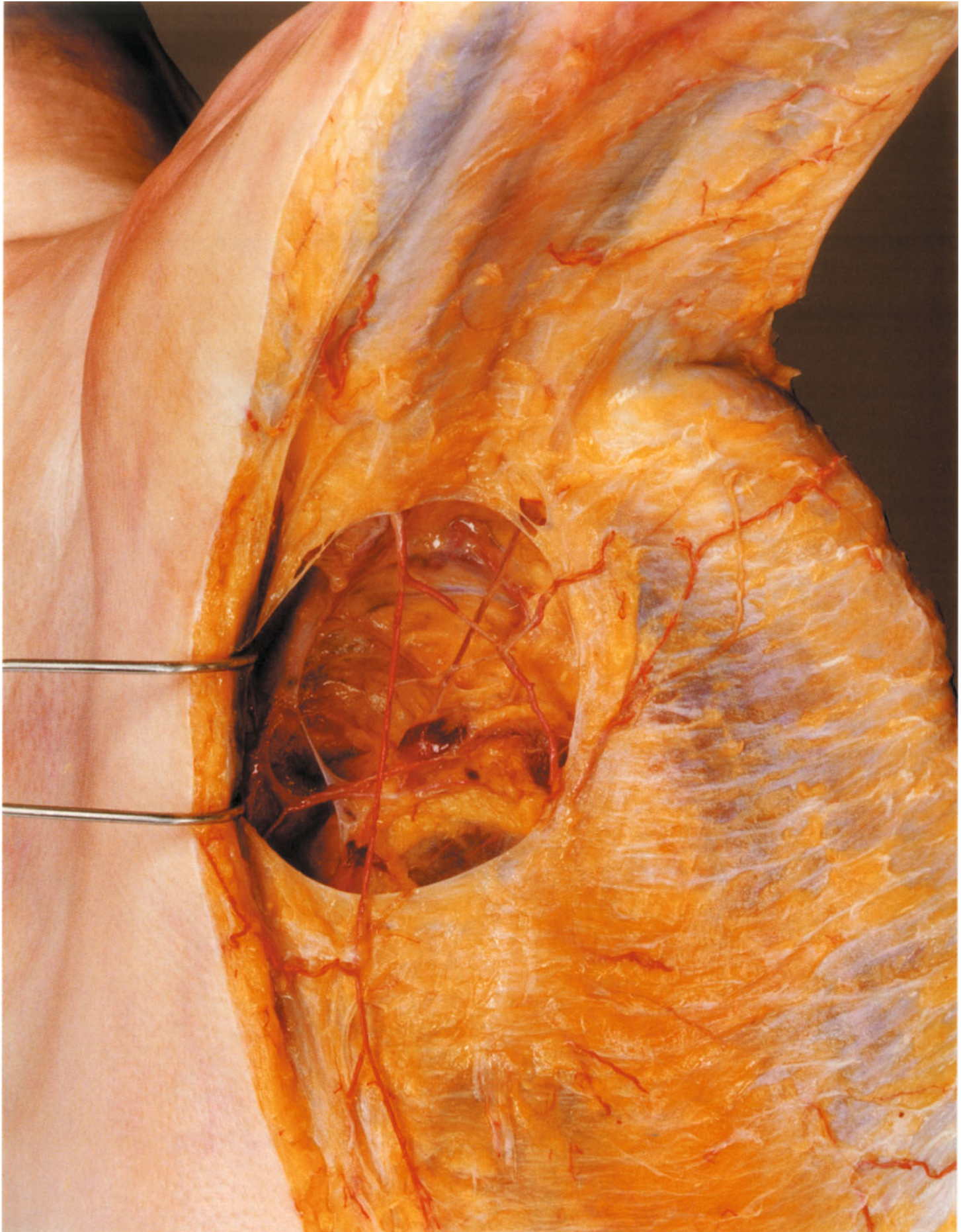


Figure 132**Axilla 5
Axillary Space 3
Fasciae**

Removing all of the axillary fat leaves a **fascia-bordered space** that lies posterior to the **clavipectoral fascia** and is called the **subfascial axillary space**, although this name is truly accurate only in the supine position.

Viewed from the lateral side and slightly from the front, this dissection displays the **posterior wall** of the space. It is formed on the anterior surface of the subscapularis muscle by a fascial layer that differs from the fascia of the subscapularis by the presence of fatty deposits. This layer continues downward from the fascia that covers the neurovascular bundle and forms the **superior wall** of the space, combining with it to form the **deep axillary fascia**. Laterally it covers the quadrangular and triangular spaces of the axilla and blends with the fascia of **teres major muscle**. In the deep groove between the subscapularis and chest wall, the layer is reflected onto the thin fascia of the **serratus anterior muscle** that constitutes the **medial wall**.

The apex of this pyramidal cavity is directed toward the lateral half of the clavicle and extends below the **pectoralis minor muscle**, where the **deep axillary fascia** connects with the posterior layer of the **clavipectoral fascia**. In this dissection the apex still contains some fatty tissue and two small **apical lymph nodes**.

The **subscapular fascial layer** transmits the **subscapular nerve** for the **teres major muscle** in its lateral portion and the **thoracodorsal nerve** for the **latissimus dorsi muscle** in its medial portion.

The free space is traversed by the **medial brachial cutaneous nerve** (medial cutaneous nerve of the arm) and the **intercostobrachial nerve**, both of which are interconnected by an anastomosis.

The **superficial axillary fascia** and its arches are described in Fig. 129.



Here the **superficial axillary fascia** has been opened more widely and the anterior axillary fold elevated and retracted, affording a full and direct view of the posterior wall of the **axillary space**. This space is formed by the anterior surface of the **subscapularis muscle** and the base of the posterior axillary fold (formed by **teres major** and **latissimus dorsi** muscles).

Applied to the upper part of this wall is the **neurovascular bundle**, from which large structures descend in front of the **subscapular fascia**, plainly visible in this specimen. As the next figure will show, these neurovascular structures are covered by the **deep axillary fascia**, which separates them from the fascial space of the axillary fat pad. Streaky fatty deposits in this layer and in the **subscapular fascia** serve to separate and differentiate these two layers in well-nourished individuals. The nerves and vessels course in a layer that is continuous with the connective tissue of the quadrangular and triangular spaces of the axilla and could aptly be called the **subscapular fascial layer**.

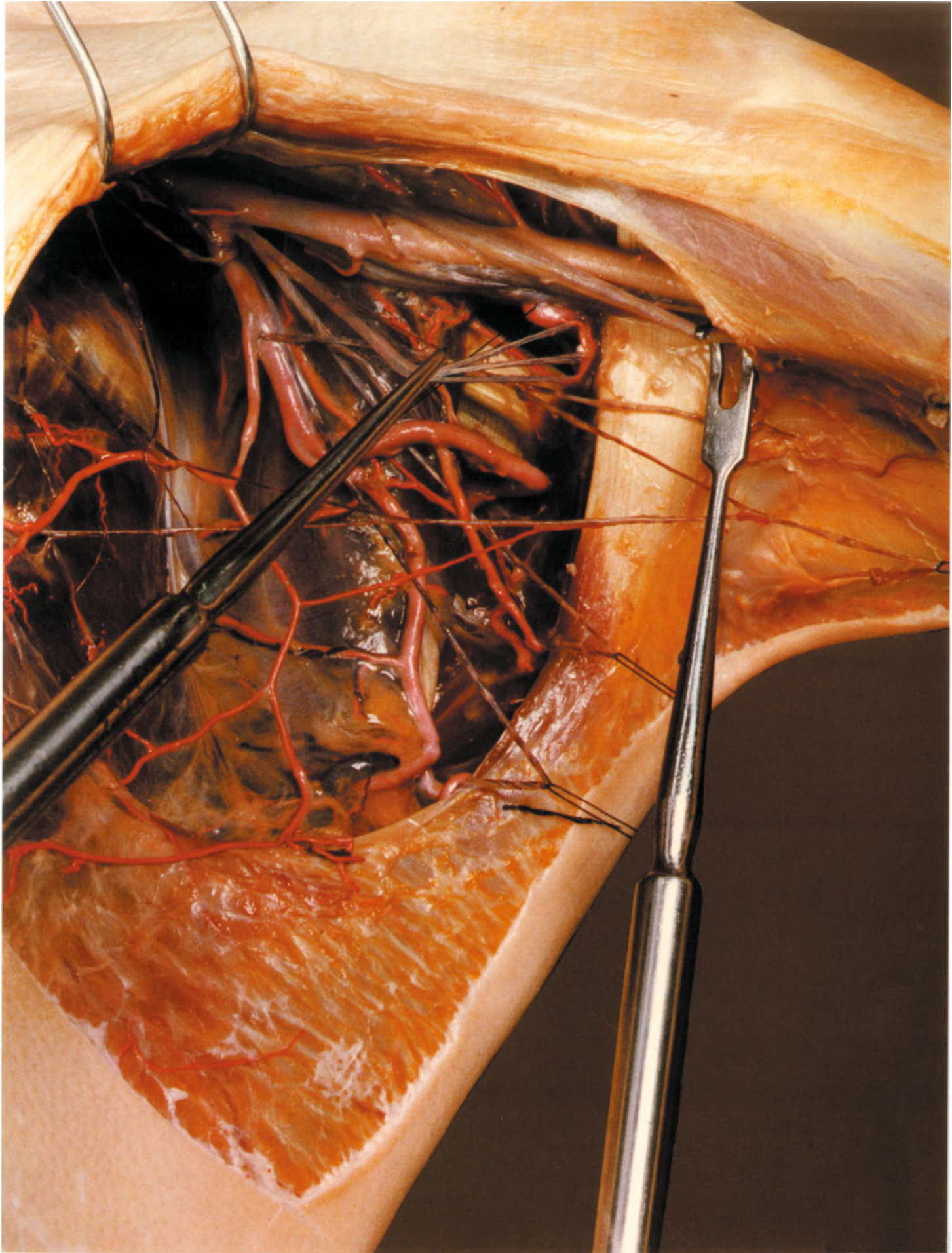
The most conspicuous structure in this layer is the **subscapular artery**, which has a very proximal origin from the **axillary artery** and thus runs in front of the subscapularis muscle. More commonly it arises distal to the union of the **median nerve roots** and descends anterior to the quadrangular and triangular spaces of the axilla. It divides near the triangular space into the **circumflex scapular artery** and the **thoracodorsal artery**.

The **circumflex scapular artery** passes through the triangular space, which lies directly below the quadrangular space when the arm is at right angles to the trunk due to rotation of the scapula. The artery supplies the musculature on the posterior side of the scapula.

If a different artery supplies the peripheral territory of the **thoracodorsal artery**, the latter consists of a branch that mainly supplies the lower part of the subscapularis muscle and is therefore called the **infrascapular branch** of the subscapular artery.

The **posterior circumflex humeral artery** and the **axillary nerve**, which pass through the quadrangular space, have been pulled downward with a hook and thread, drawing the division of the axillary nerve into view.

Traction threads mark the **subscapular nerves**, and the **medial brachial cutaneous nerve** takes an unusual course below a division of the subscapular artery.



In this dissection the superficial fasciae, including the **superficial axillary fascia**, have been removed, and the **pectoralis major muscle** has been widely resected. This exposes the front of the **clavipectoral fascia**, which extends to the anterior axillary fold. Part of the **pectoralis minor muscle** can be seen through its anterior layer, and branches of the **lateral thoracic artery** pierce it near its free border. The **deltoid** and **acromial branches** of the **thoracoacromial artery** and its accompanying veins course on the surface of the fascia.

The **clavipectoral fascia** forms the anterior wall of a fascial space that is filled with axillary fat and is called the **subfascial axillary space**. Its posterior wall is formed by the **deep axillary fascia**, which covers the vessels and nerves that relate to the fascia of the subscapularis muscle. The deep fascia is thin and transparent, and the nerves and vessels can be seen through it without further dissection. The **subscapular artery** follows a course similar to that in the previous figure, and it is accompanied by large veins that connect the **axillary vein** with the **posterior intercostal veins**.

The **deep axillary fascia** in front of the subscapularis muscle stretches over the fat-filled **quadrangular space** and **triangular space** to the **teres major muscle** and blends superiorly with the part of the deep axillary fascia that covered the **neurovascular bundle** and **coracobrachialis muscle**, forming a common fascial layer of variable convexity that extends with the neurovascular bundle below the **pectoralis minor muscle**. There it unites with the posterior layer of the **clavipectoral fascia** to form part of the boundary of the clavipectoral space (of TESTUT).

The fascial space containing the axillary fat pad is traversed by the **intercostobrachial nerve** and several **lateral cutaneous branches** of the superior intercostal nerves. There may also be a **costoaxillary vein** (of BRAUNE) accompanied by an analogous, unnamed artery. Additionally, substantial vascular branches pass to the lymph nodes and distribute cutaneous branches to the axillary fossa.



The **superficial axillary fascia** and adjacent superficial fasciae have been removed. Visible between the exposed anterior and posterior axillary folds is the **axillary fat pad** with its posterior extension along the **latissimus dorsi muscle**. It is pierced above by the **intercostobrachial nerve** and farther down by several cutaneous arterial branches, most of which wind posteriorly around the **latissimus dorsi muscle**. But several branches pass forward and are distributed inferiorly to the anterior axillary fold, where they are supplemented by branches from the **lateral thoracic artery**.

These vessels may be **lateral cutaneous branches** from the **posterior intercostal arteries**, or they may arise from a superficial artery (described later in more detail) that accompanies the costoaxillary vein and forms several anastomoses with the posterior intercostal arteries.

Several lymph nodes are visible on the surface of the axillary fat pad. At the lower border of a **subscapular lymph node**, the **costoaxillary vein** (of BRAUNE) becomes superficial and anastomoses with several **posterior intercostal veins** along the lateral chest wall.

The highest part of the posterior axillary fold is supplied by a **cutaneous branch** of the **brachial artery**. Two larger cutaneous branches emerge from the territory of the **thoracoacromial artery** and become superficial on both sides of the clavicular part of the pectoralis major muscle. The skin over the **pectoralis major muscle** is supplied from the medial side by the **perforating branches** of the **internal thoracic artery** from the six upper intercostal spaces.

The segment of the **serratus anterior muscle** that was directly covered by the **superficial axillary fascia** can be seen anterior to the lower extension of the axillary fat pad. That part of the muscle is clearly invested by the thin serratus anterior **fascia**.



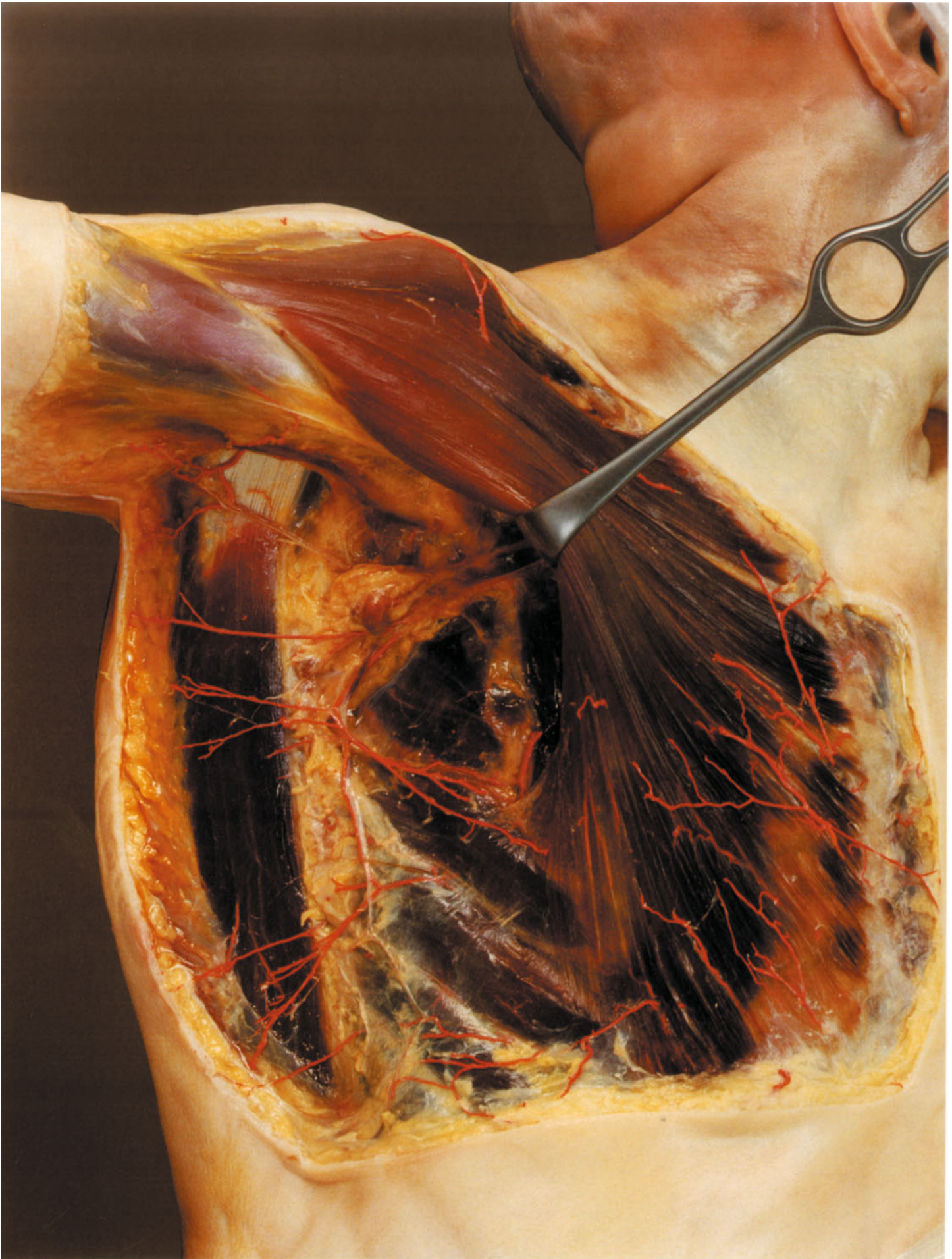
The lateral border of the **pectoralis major muscle** has been elevated and retracted medially to expose the underlying **pectoralis minor muscle** and, along its lateral border, a descending anterior extension of the **axillary fat pad**. The **pectoral lymph nodes** occur on and within this extension. The lowest of these nodes, called the **node of Sorgius**, lies on the slip of the **serratus anterior muscle** from the third rib and is quite large in this specimen.

One intercostal space lower is a small lymph node, not always present, called the **paramammary node** (of GEROTA), which contributes to the lymphatic drainage of the breast.

Several **interpectoral lymph nodes** are visible between the **pectoralis major muscle** and **pectoralis minor muscle**, and one **subpectoral lymph node** appears at the lateral border of pectoralis minor.

The **axillary fat pad** has been partially dissected open, exposing two **central lymph nodes** within its substance and, on its surface, a **brachial lymph node** adjacent to the tendon of the **latissimus dorsi muscle**. The surface of a **subscapular lymph node**, lying at a slightly deeper level, has also been dissected free.

The group of **subscapular lymph nodes** is traversed by the **costoaxillary vein**, whose side branches accompany the **lateral cutaneous branches** of the **posterior intercostal arteries**. The vein extends far enough inferiorly to unite with the **superficial epigastric vein** and form the **thoracoepigastric vein**. It is accompanied by an artery that has no definite counterpart in the anatomic nomenclature and will be described more fully in the next figure.

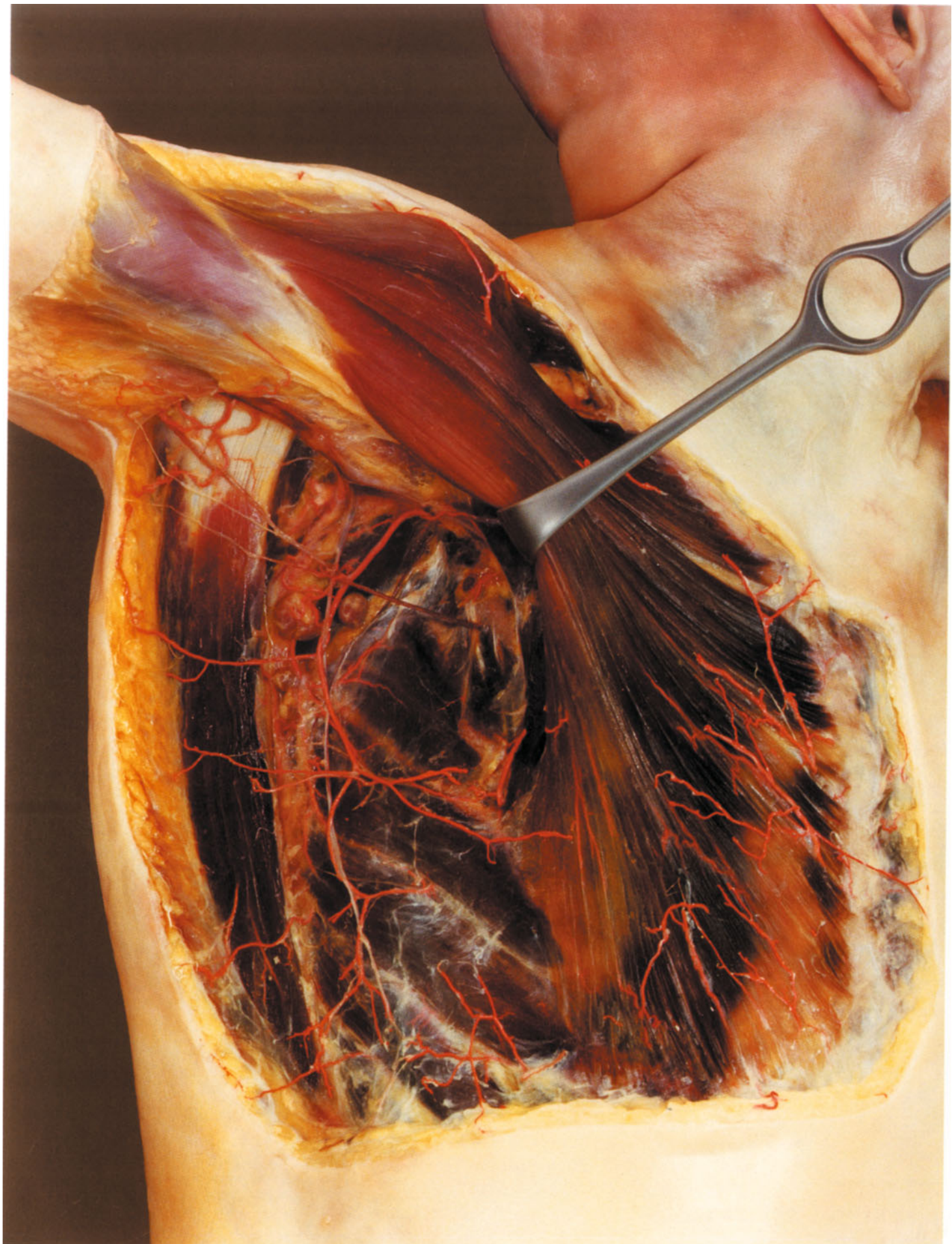


In removing the axillary fat pad, we isolated an arterial vessel that did not appear among the named vessels in the standard nomenclature. Textbooks of vascular anatomy note the marked **variability** of the axillary blood supply, but this is not helpful in interpreting a specific dissection. We shall use the present specimen, therefore, in an attempt to resolve some of the uncertainties in this region.

The **accessory artery** in question may arise separately from the **axillary artery** or may branch from the **subscapular artery** as shown in Fig. 133. It lies between the two axillary folds and thus between the **lateral thoracic artery** and the **thoracodorsal artery** (from the subscapular). It distributes branches to the anterior and posterior axillary folds and has multiple anastomoses with the **posterior intercostal arteries** – some direct and some mediated by the **lateral cutaneous branches**. Thus, the course of this vessel is analogous to that of the vein known as the **costoaxillary vein** (of BRAUNE), which connects posterior intercostal veins with the axillary vein.

Any of the three arteries – the accessory artery, thoracodorsal, or lateral thoracic – may supply most or all of the peripheral **territories** of these vessels. In cases where the **thoracodorsal artery** assumes this function, it arises directly from the **axillary artery** rather than from the subscapular artery. In those cases it gives off an **infrascapular branch** to supply the lower portion of the subscapularis muscle. In other cases the thoracodorsal artery may supply all of the territory of the central accessory artery or even that of the lateral thoracic artery. The main trunks then distribute more modest arteries to the lymph nodes, which consistently receive branches from all three arteries.

The accessory artery has been described by **MANCHOT**, who stressed its rather consistent occurrence and called it the **superficial thoracic artery** (also applying that term to an alternative artery that skirts the lateral border of the pectoralis muscle). The large anterior branch of the artery at the level of the fourth rib, present even with the lateral version in this specimen, signifies its involvement in the blood supply to the breast.



With the fasciae on and between the axillary folds completely removed, the slips by which the **serratus anterior muscle** arises from the lateral chest wall are clearly visible, especially on the second and third ribs. The **intercostobrachial nerve** emerges just below the second rib. Anterior to that site, the **lateral thoracic artery** emerges from behind the **pectoralis minor muscle** in typical fashion and anastomoses with the intercostal arteries.

Medial retraction of the **pectoralis major muscle** exposes the branch of the **medial pectoral nerve** [posterior pectoral nerve] that pierces the **pectoralis minor muscle** to supply the **pectoralis major**.

The **lateral cutaneous branches** of the intercostal vessels that emerge between the slips of the **serratus anterior muscle** have been resected. Farther posteriorly, the **long thoracic nerve** descends on **serratus anterior** in the groove between that muscle and the **subscapularis**, where it is invested by a thickened portion of the **serratus fascia**. A strip of this fascia has been preserved where it separates the **subscapularis muscle** from the **serratus anterior**.

Descending from the **axillary vein** is a fully collapsed vein whose connections with the posterior intercostal veins have been severed. This is the **costoaxillary vein** (of Braune), which has given rise to a **thoracoepigastric vein**. The accompanying accessory artery was resected after its origin was identified.

The **subscapular artery** in this specimen arises from the **axillary artery** distal to the union of the **median nerve roots**, at once gaining the groove between the **subscapularis** and **teres major muscles**. Thus it runs only a short distance before giving off the **circumflex scapular artery** posteriorly through the triangular space, while the **thoracodorsal artery** simply descends in the aforementioned groove and, accompanied by the **thoracodorsal nerve**, passes to the deep surface of the **latissimus dorsi muscle**.



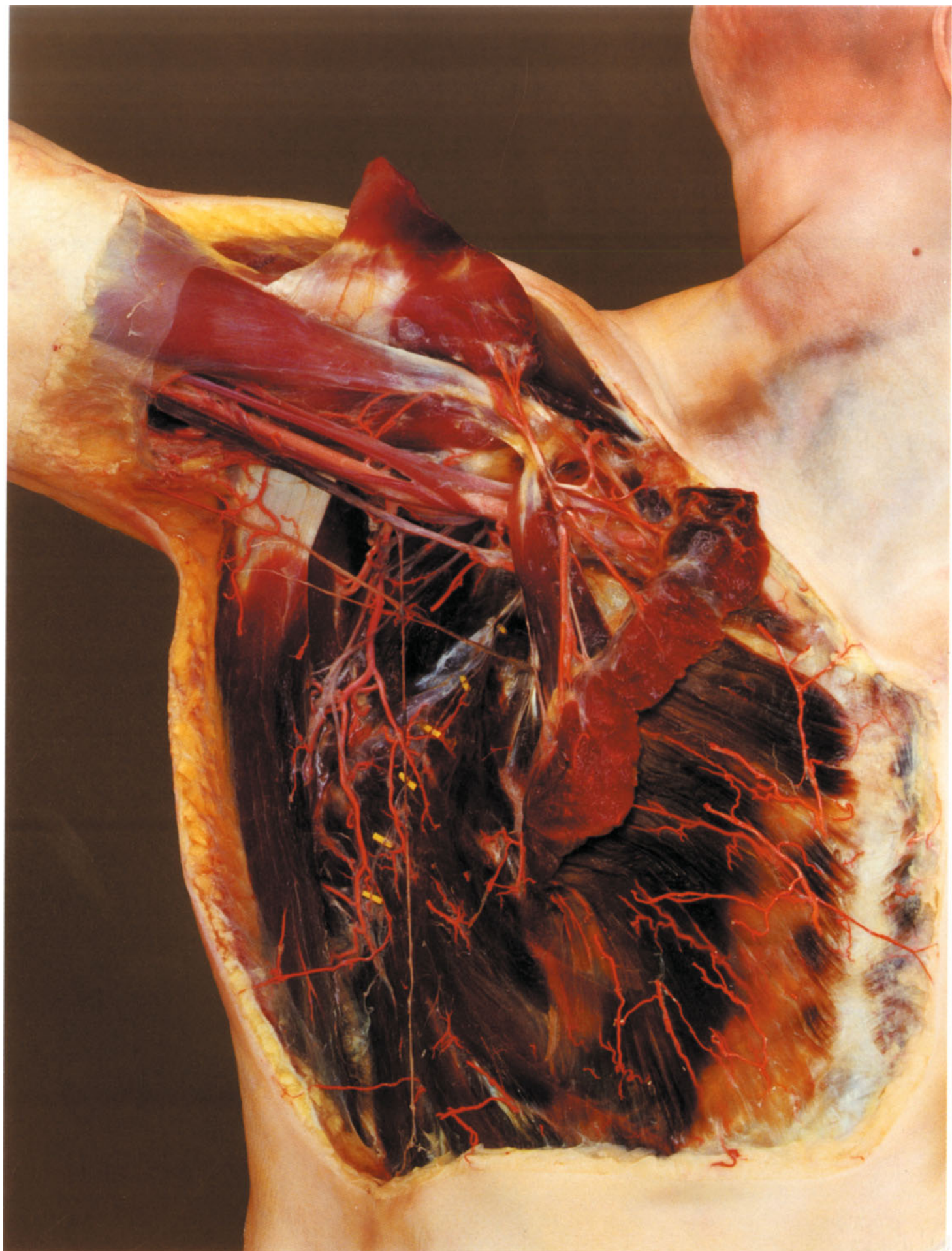
The **pectoralis major muscle** has been divided and reflected to demonstrate all three parts of the **axillary artery**. The first part extends from the lateral border of the first rib to the medial border of the pectoralis minor muscle. It gives off the short trunk of the **thoracoacromial artery** and was described previously in connection with the infraclavicular region.

The second part of the **axillary artery** is posterior to the **pectoralis minor muscle**, which usually passes from the third through fifth ribs to the medial side of the **coracoid process**. Its lateral side gives attachment to the **coracobrachialis** and the short head of the **biceps brachii**.

The lateral or third part of the **axillary artery** is the longest, extending from the lateral border of **pectoralis minor** to the lower border of **teres major** and embraced by the roots of the **median nerve**. The **lateral root** of the median nerve is derived from the **lateral cord** of the brachial plexus, which maintains a largely constant relation to the axillary artery. The **medial root** is derived from the **medial cord** of the brachial plexus, which travels some distance before gaining its medial relation to the artery, if it does so at all. Passing to the medial side of the artery from behind, the medial cord is almost completely hidden from view when the arm is in this position. It gives off the **ulnar nerve** and the **medial antebrachial cutaneous nerve** (medial cutaneous nerve of the forearm) along with the very small medial brachial cutaneous nerve, which is not shown here.

Below the site where the **axillary artery** passes between the median nerve roots and at a deeper level, the **axillary nerve** arises from the **posterior cord** of the brachial plexus and passes below the visible articular capsule of the shoulder joint to the quadrangular space of the axilla. Just lateral to the quadrangular space, the axillary artery gives off the **subscapular artery** and the **anterior circumflex humeral artery**.

A **posterior circumflex humeral artery**, described as accompanying the axillary nerve through the quadrangular space, may be obscured by the axillary artery or, as is often the case, may be replaced by a circumflex branch of the **profunda brachii artery**.



The structures that converge in the axilla to form a **neurovascular bundle** leave the axilla at the tendon of the **latissimus dorsi muscle** and enter the **medial bicipital sulcus** of the arm, which initially is bounded not by the biceps muscle but by the distal part of the **coracobrachialis muscle**.

The **center** of the neurovascular bundle is occupied by the **brachial artery**, which is the continuation of the axillary artery. In the abducted arm, the **median nerve** lies superior to the brachial artery in the neurovascular bundle past the union of its lateral and medial roots. Below the brachial artery is the **medial antebrachial cutaneous nerve**, which is derived from the medial cord of the brachial plexus. This nerve has an impressive diameter, as it not only supplies a large part of the forearm (as its name implies) but also distributes one or more **brachial cutaneous branches** to the anterior side of the upper arm. One such branch, partially resected, has been isolated to show its substantial size.

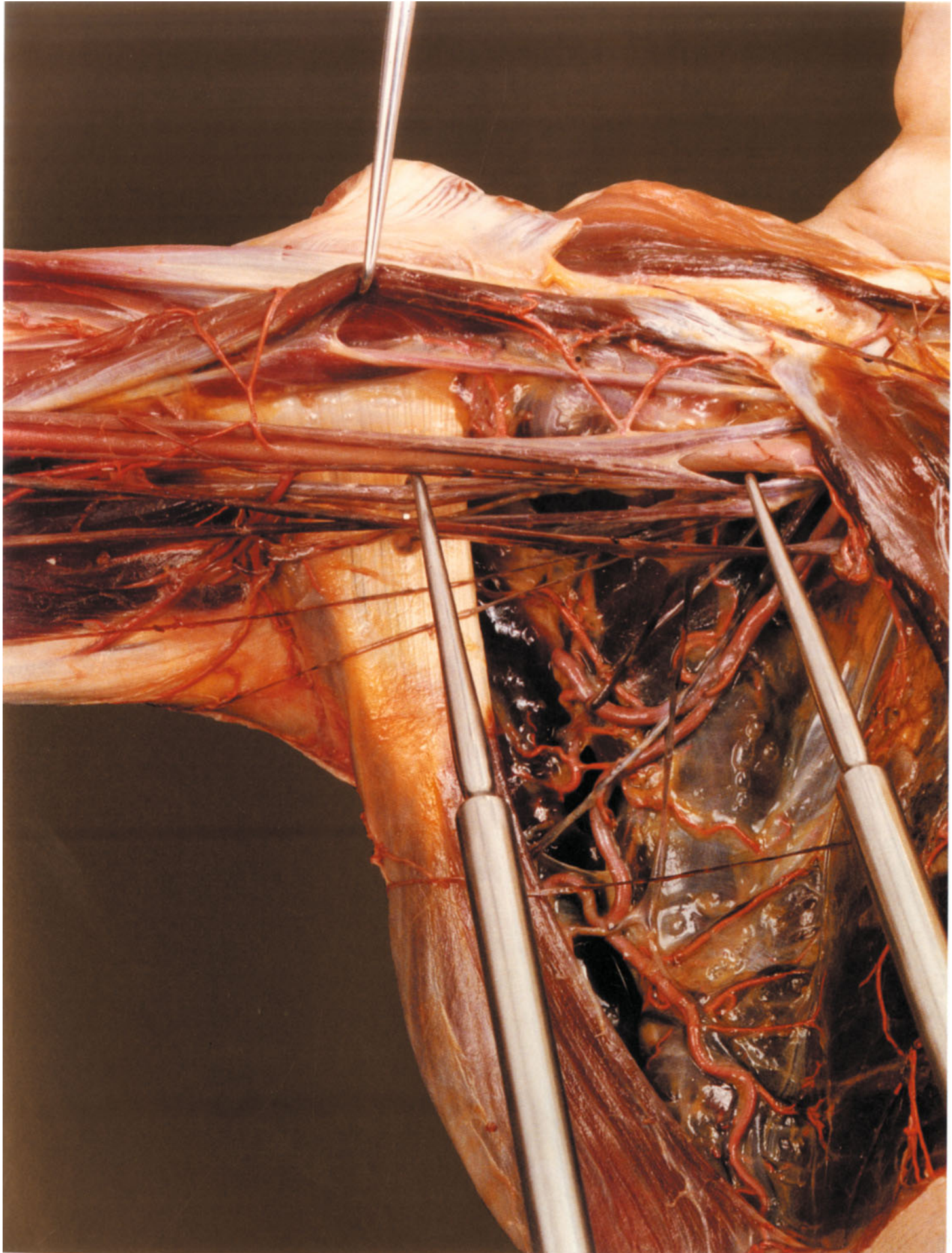
From this **axis** of the **neurovascular bundle**, nerves continue distally from the cords of the brachial plexus. Hooks have been used to separate and display the nerves more clearly.

The **musculocutaneous nerve** arises from the **lateral cord** of the brachial plexus before entering and piercing the retracted **coracobrachialis muscle**.

The **medial cord**, here pulled slightly downward, gives rise to the **ulnar nerve**, which passes over the long head of the triceps muscle to its medial head. The two medial brachial cutaneous nerves also arise from the medial cord of the brachial plexus. The **medial brachial cutaneous nerve** in this specimen replaces the **intercostobrachial nerve** and is distributed to the skin area normally supplied by that nerve.

While the intercostobrachial nerve may sometimes replace the medial brachial cutaneous nerve, this specimen lacks an **intercostobrachial nerve**, and the lateral cutaneous branch of the second intercostal nerve is rudimentary. The **lateral cutaneous branch** of the **third intercostal nerve** is very substantial, however, and has been demonstrated.

The large **radial nerve**, the continuation of the **posterior cord** of the brachial plexus, enters the posterior compartment of the upper arm between the long head of the triceps brachii muscle and the humeral shaft. The nerve has been pulled slightly downward from its posterior position.



The **brachial artery** has been pulled downward with the **median nerve** to display the **entrance** to the **posterior compartment** of the arm (the “triceps hiatus”). The **radial nerve** enters this compartment after passing over the flat tendon of the **latissimus dorsi muscle**. A continuation of the posterior cord of the brachial plexus, the radial nerve is the deepest structure in the neurovascular bundle and lies in contact with the latissimus dorsi tendon. There it gives off the **posterior brachial cutaneous nerve**, which winds posteriorly around the attachment of the long head of the triceps brachii muscle.

The **entrance** to the **posterior compartment** lies between the long head of the triceps brachii and the humeral shaft. After passing over the proximal part of the medial head of the triceps brachii, the radial nerve enters the **radial groove** (spiral groove) of the humerus. The **lateral head** of the triceps brachii covers the groove and converts it to a canal.

The **radial nerve** is accompanied on this path by the **profunda brachii artery**, which arises from the brachial artery just lateral to the latissimus dorsi tendon, so even its initial portion lies in close proximity to the radial nerve.

The **ulnar nerve**, derived from the medial cord of the brachial plexus, inclines downward in the horizontally elevated arm and comes into contact with the long head of the triceps brachii muscle, where it is soon accompanied by the **superior ulnar collateral artery**, which arises from the brachial artery.

The **anterior circumflex humeral artery** arises in the quadrangular space and disappears behind the coracobrachialis muscle, which is supplied by two other muscular branches.

The **musculocutaneous nerve** is visible between the short head of the biceps brachii muscle and the coracobrachialis muscle, having just pierced the latter.

The **medial brachial vein** accompanying the brachial artery has been retracted downward to show its assumption of the **lateral brachial vein** and its connection with the profunda brachii vein.



The **superficial brachial fascia** is not a continuous sheet as its name might suggest. It is structurally more complex and subject to the same conditions described in Volume I.

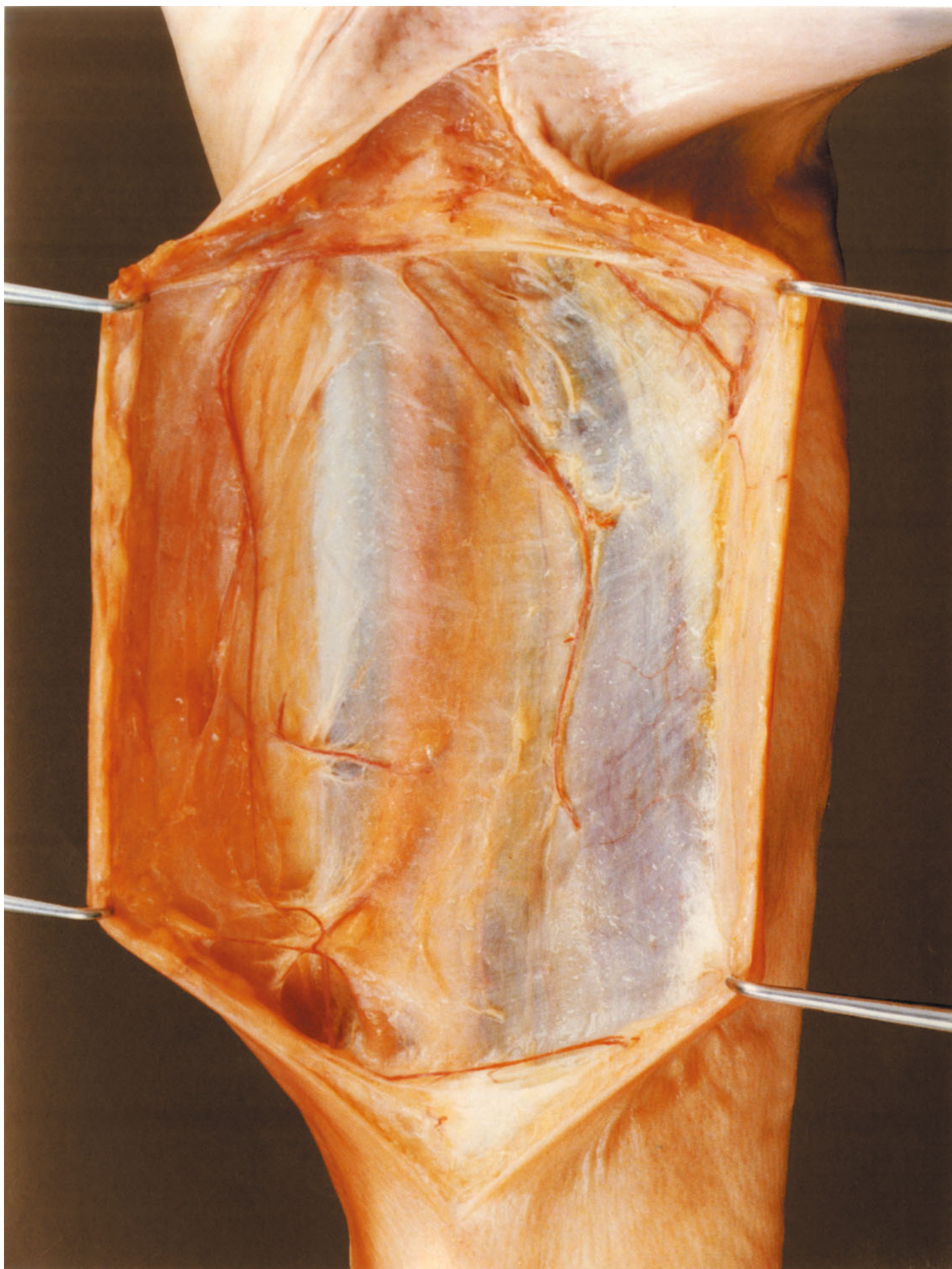
Large portions of it are composed of true **superficial fascia** and the attached **deep layer of the stratum subcutaneum**. In the area of the **medial bicipital sulcus**, the deep layer of stratum subcutaneum becomes extended to form the **flat tunnels** described in Volume I, creating a strip of low transparency due to the fat content of the tunnel.

The yellowish strip contains the **basilic vein** and the **medial antebrachial cutaneous nerve**. Both structures pass through the superficial brachial fascia at a site usually represented as a **hiatus**, although this is actually an artifact that can be produced to a degree only in emaciated individuals. This feature will be discussed more fully in our description of the cubital veins.

As the dissection shows, platelike condensations of connective tissue extending from the **deep layer of the stratum subcutaneum** accompany the vessels and nerves as they pass to the skin. Superficial to the neurovascular structures they form **streaklike condensations** that are particularly effective in protecting longitudinally oriented structures from mechanical trauma.

The dissection illustrates that the nerves traversing the deepest layer of the **subcutaneous tissue** are accompanied by delicate blood vessels for a considerable distance. Just past the axilla, the **medial antebrachial cutaneous nerve** gives off an anterior **brachial cutaneous branch** that runs alongside the nerve in the subcutaneous tissue almost to the elbow and supplies the anterior surface of the upper arm. The **medial brachial cutaneous nerve** and the **intercostobrachial nerve** are distributed to the posterior surface of the upper arm and again are accompanied by very long, thin vessels.

Anterior and posterior to the strips along the medial bicipital sulcus, the **biceps brachii muscle** and the **long head** of the **triceps brachii** are visible through the semitransparent fascia.



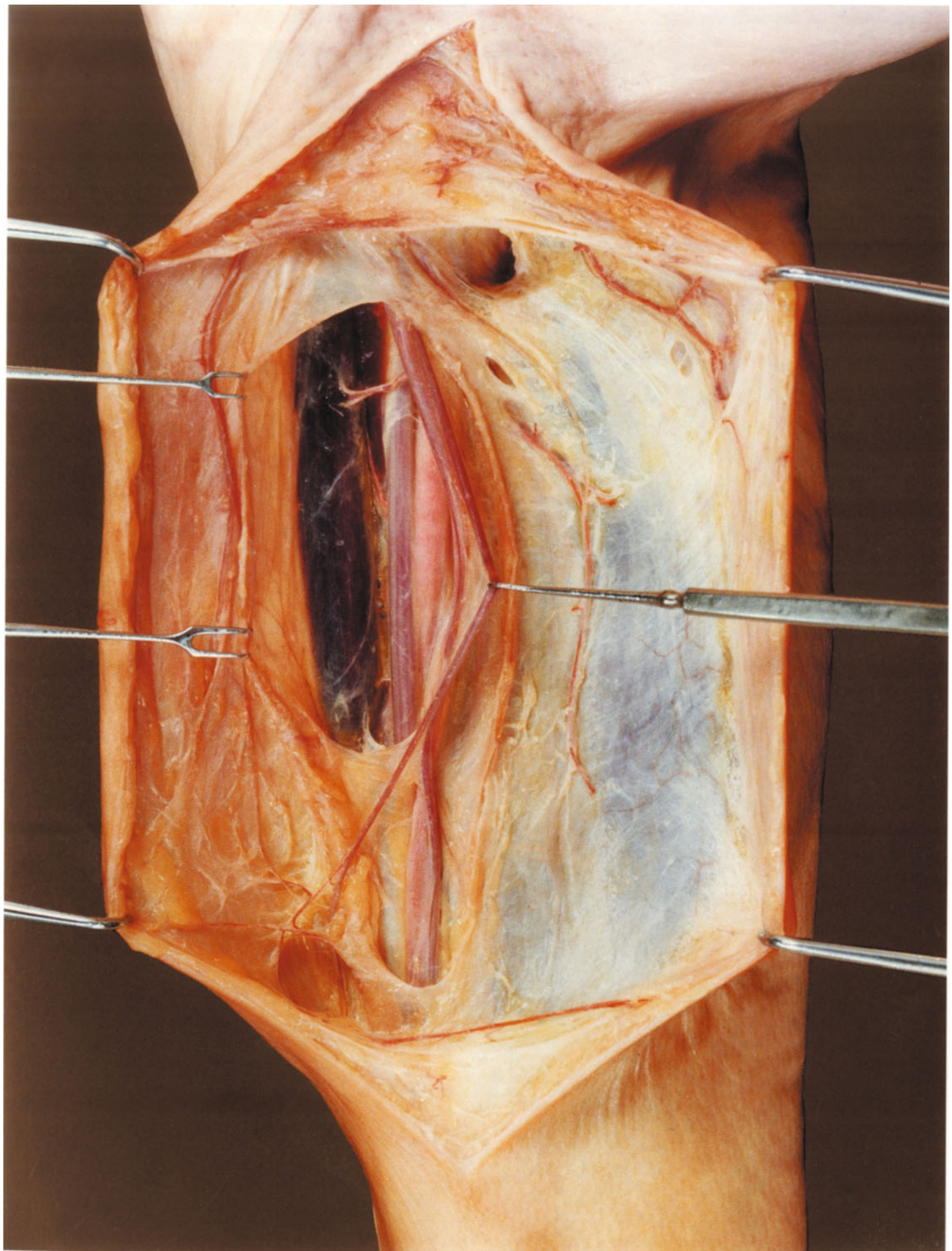
The flat tunnel over the distal part of the **medial bicipital sulcus** has been opened, and the **basilic vein** and adjacent **medial antebrachial cutaneous nerve** have been dissected free. At this level the medial antebrachial cutaneous nerve gives off a **brachial cutaneous branch** that anastomoses with the **lateral antebrachial cutaneous nerve**, adding to its anterior branch a **collateral branch** (of the medial antebrachial cutaneous nerve) that extends far laterally into the anterior cubital region.

The **floor** of the **flat tunnel** transmitting these structures passes over the neurovascular bundle of the arm, just superficial to the biceps brachii muscle, and attaches to the **medial intermuscular septum**. It gradually thins in the proximal direction and finally ends, the **roof** of the **flat tunnel** blending with the normal **superficial fascia** near the top of the figure while the tunnel connects with the space of the neurovascular bundle.

The **neurovascular bundle** is enclosed in a sheath that has been partially removed at the center of the field, demonstrating the tendency of the exposed **median nerve** to spiral in its course through the upper arm, crossing from the lateral to the medial side of the **brachial artery**.

The distal part of the **coracobrachialis muscle** is visible on the lateral side of the neurovascular bundle, and anterior to it the **biceps brachii muscle** is covered by its very thin muscle fascia.

Posterior to the neurovascular bundle, a branch of the **medial brachial cutaneous nerve** and the **intercostobrachial nerve** are embedded in the **deep layer of the stratum subcutaneum**. Another medial cutaneous nerve branch at a deeper level has been exposed through a short incision.



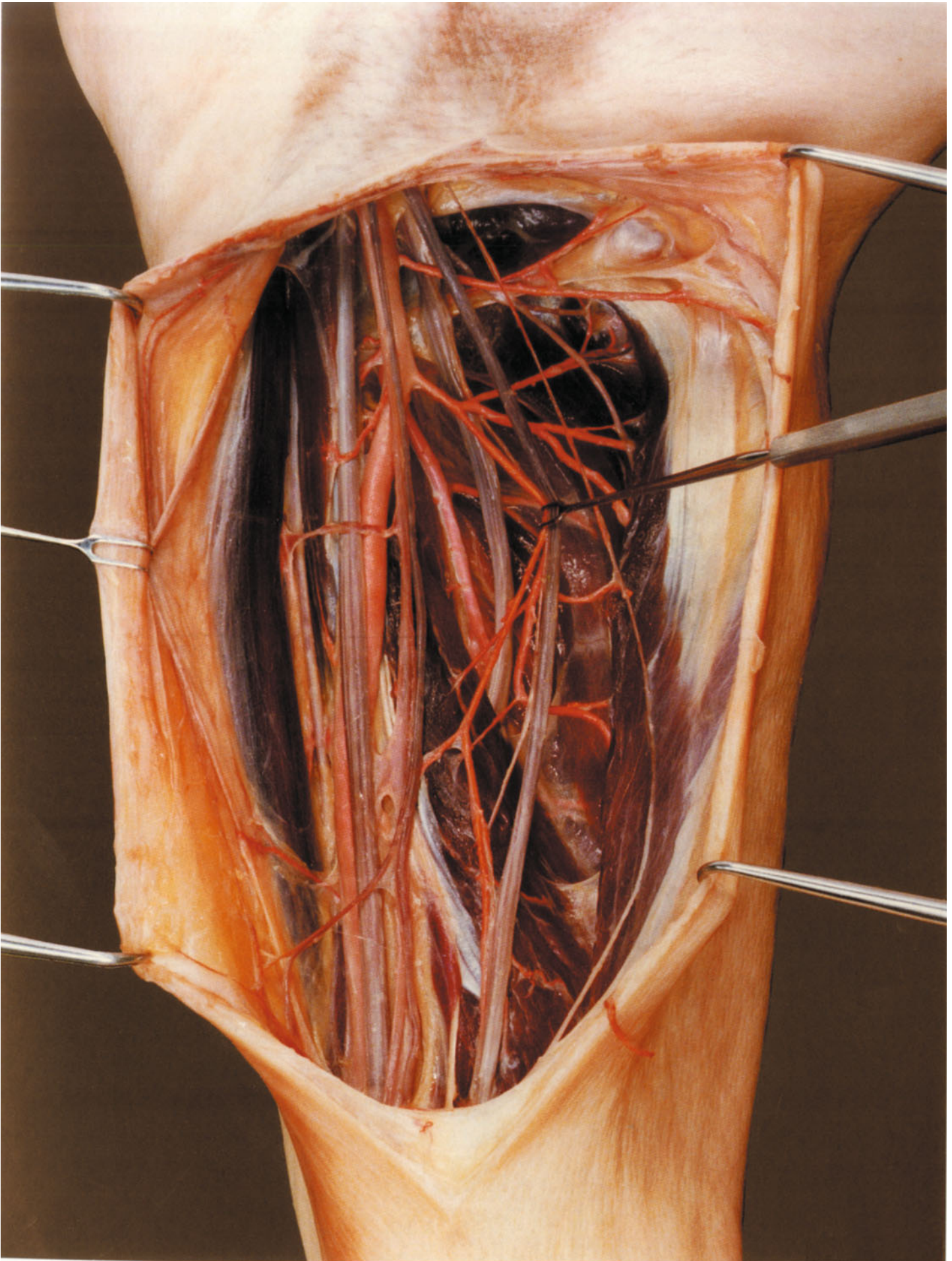
The skin and fasciae on the medial side of the upper arm have been retracted, producing wide separation of the adherent musculature. The separation of the **biceps brachii muscle** from the **long head** of the **triceps brachii** has created a deep intermuscular furrow whose lateral wall is formed by the **lateral head** of the triceps muscle. This has also exposed the posterior surface of the **medial head** of the triceps, enabling us to see the **profunda brachii artery** lying in the groove between the two heads and also the **radial collateral artery**, which approaches the radial nerve after arising from the distal part of the profunda brachii artery. Initially the **radial nerve** is related to the upper end of the medial head of the triceps brachii, lying medial to the profunda brachii artery, before it enters the **radial groove** of the **humerus**. The retraction in this specimen has displaced the median nerve posteriorly over the artery.

The **ulnar nerve** and its **superior collateral artery** have been retracted posteriorly. In this case the artery arises from a large **muscular branch** of the brachial artery for the long head of the triceps brachii. The hook is simultaneously retracting a **radial nerve** branch to the **medial head** of the triceps brachii, which accompanies the ulnar nerve and is therefore called the **ulnar collateral branch** of the **radial nerve**.

The **medial brachial nerve**, whose presence is not unusual, appears as a very long, thin branch passing to the **medial epicondyle** of the humerus and covered for much of its length by superficial fascia.

The retraction has not significantly altered the position of the residual neurovascular bundle, except that the **biceps brachii muscle** has been slightly displaced from the neurovascular bundle and the **brachialis muscle** can be seen.

The **brachial veins** have already joined the **basilic vein** at a far distal level, the **medial brachial vein** appearing as a relatively thin vessel that accompanies the **medial antebrachial cutaneous nerve** to the edge of the field.



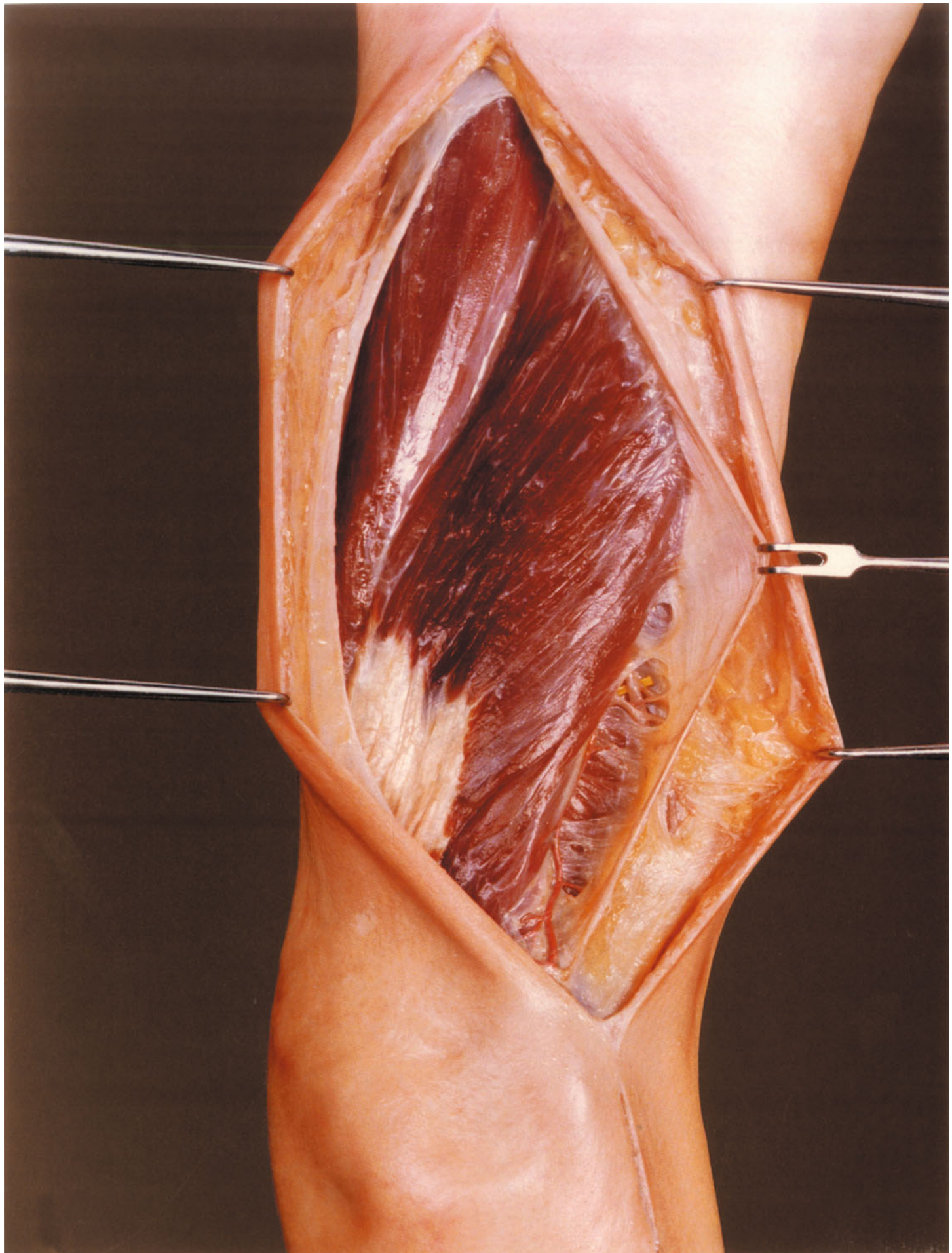
The **posterior brachial region** contains a single muscle, the **triceps brachii**, which consists of two superficial heads and one deep head. The two superficial heads are separated by a distinct interval that widens proximally before it is overlapped by the posterior part of the **deltoid muscle**.

The two superficial heads of the triceps brachii muscle insert by a **common tendon** into the olecranon of the ulna. On the radial side of the ulna, an aponeurotic expansion is continued downward to the posterior surface of the brachioradialis muscle group. The common tendon of the triceps brachii begins about a handwidth distal to the posterior border of the **deltoid muscle**, forming a very abrupt musculotendinous junction that greatly affects the surface contour of the arm in lean, muscular individuals.

The **skin incision** in this dissection extends from the center of the posterior border of the **deltoid muscle** to the center of the **elbow**. The incision has been retracted to expose a field whose anterosuperior edge lies just distal to the posterior border of the deltoid muscle.

Besides the skin itself (the **common integument**), the relatively thick **superficial brachial fascia** has been mobilized and retracted to expose its anteroinferior attachment to the **lateral intermuscular septum**. Between that attachment and the anterior border of the **lateral head** of the triceps brachii is a long rectangular area in which the deep or **medial head** of the triceps brachii can be seen despite the posterolateral angle of view.

The **posterior antebrachial cutaneous nerve**, visible behind the **lateral intermuscular septum**, descends in front of the **lateral epicondyle** of the humerus to the posterior side of the forearm. Somewhat farther distally the **posterior branch** of the **radial collateral artery** emerges at the border of the lateral head of the triceps and unites with the **recurrent interosseous artery**.



The interval between the **lateral head** and **long head** of the **triceps brachii muscle** has been widened below the posterior border of the deltoid muscle to show the entrance of the **radial nerve** into the posterior compartment of the arm. The nerve is covered by a transparent fascia that extends from the deep surface of the **lateral head** of the triceps brachii muscle to the deep surface of its **long head** and is part of the fascial layer that stretches between the two superficial heads of the triceps brachii and its deep head. Accordingly, this fascia also covers the proximal end of the **medial head**, upon which the radial nerve descends in this area.

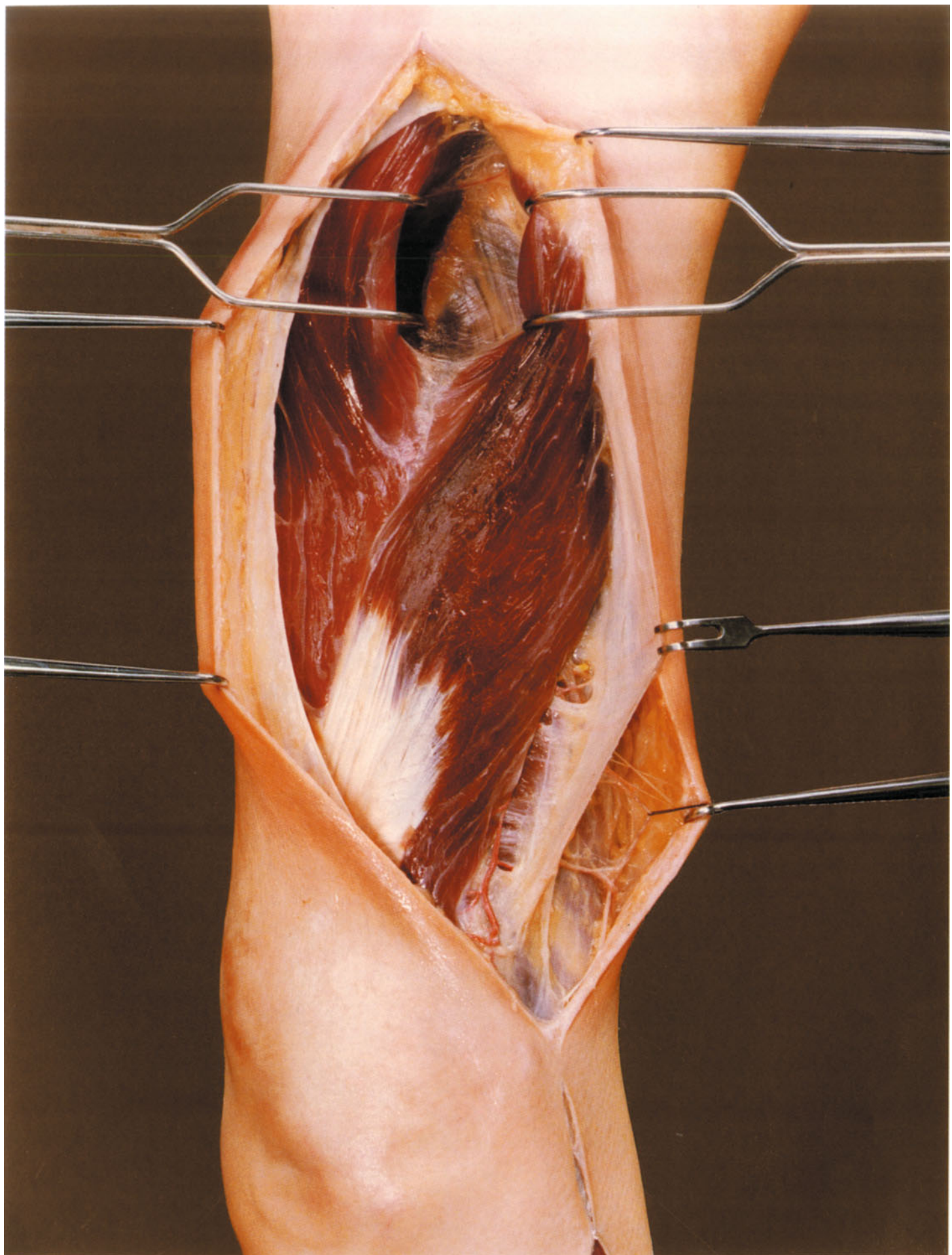
Because of this arrangement, the **radial nerve** does not run directly on the **humerus** as it enters the posterior compartment of the arm, and the humerus at that level does not possess a **radial groove**, which is traditionally described as separating the origins of the two heads of the triceps.

The **radial nerve** in this area consists basically of a single cord. It has already given off its branches to the **long head** of the triceps brachii muscle before entering the posterior compartment, and it has yet to distribute branches to the lateral and medial heads.

It is also noteworthy that neither the **lateral collateral artery** nor the **middle collateral artery** are closely related to the **radial nerve** in this area.

The **posterior antebrachial cutaneous nerve** is tagged in the distal half of the field, where its relation to the superficial brachial fascia and the attachment of the fascia to the lateral intermuscular septum can be seen.

Anterior to the **lateral intermuscular septum**, the **superficial brachial fascia** still covers the **brachioradialis** and **extensor carpi radialis longus** muscles.



Here the thick fascia on the deep surface of the **lateral head** of the **triceps brachii muscle** stretching to the deep, fleshy part of the **long head** of the triceps brachii has been removed to expose the **radial nerve**, which is flanked by two arteries.

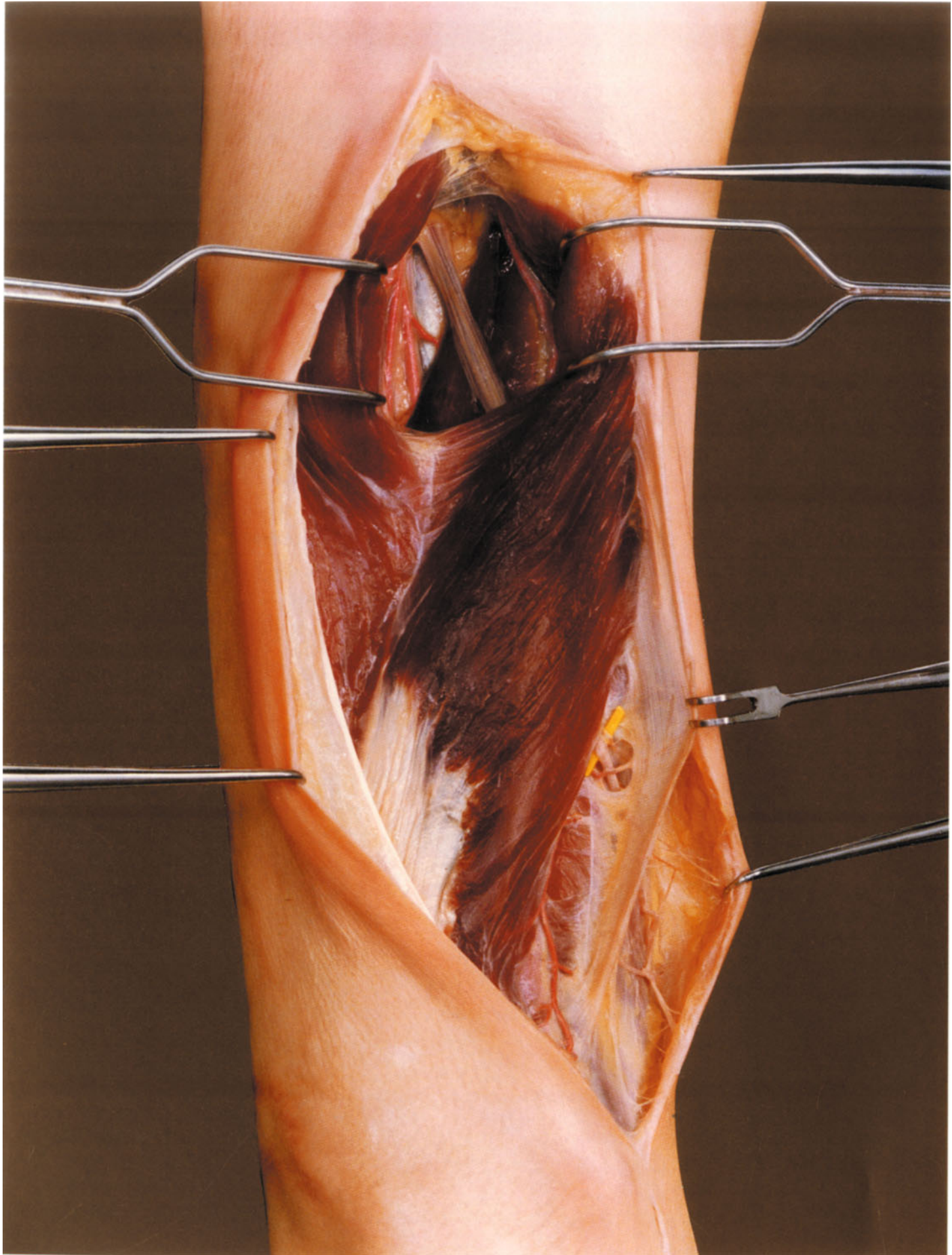
The white area behind the radial nerve is part of the **deep tendon** that interconnects the three heads of the **triceps brachii muscle** and extends deeply from the muscle surface around the medial border of the **medial head** but does not reach the medial surface of the **long head**, which has its own tendinous expansion.

This deep tendon is in contact with the **radial nerve** and **middle collateral artery**, so retracting the long head of the triceps brachii muscle has separated these structures somewhat from the posterior surface of the **humerus**.

After entering the posterior compartment of the arm, the **radial nerve** runs obliquely across the back of the humerus, passing between the **medial head** and **lateral head** of the triceps brachii muscle and then entering the **radial groove** of the humerus deep to the lateral head. Meanwhile the **middle collateral artery** and its branches pass to the deep surface of the **medial head**, thereby entering the space between the posterior surface of the humerus and the medial head.

The **lateral collateral artery** has entered the groove between the origins of the **lateral head** and **medial head** of the triceps brachii muscle; its position is unaffected by the retraction. The **posterior branch** of this artery appears in the lower part of the field at the distal border of the lateral head and will anastomose with the **recurrent interosseous artery**.

The tagged **posterior antebrachial cutaneous nerve** passes to the surface with the **lateral intermuscular septum**, but its larger branches are still covered by the superficial fascia of the brachioradialis muscle group.

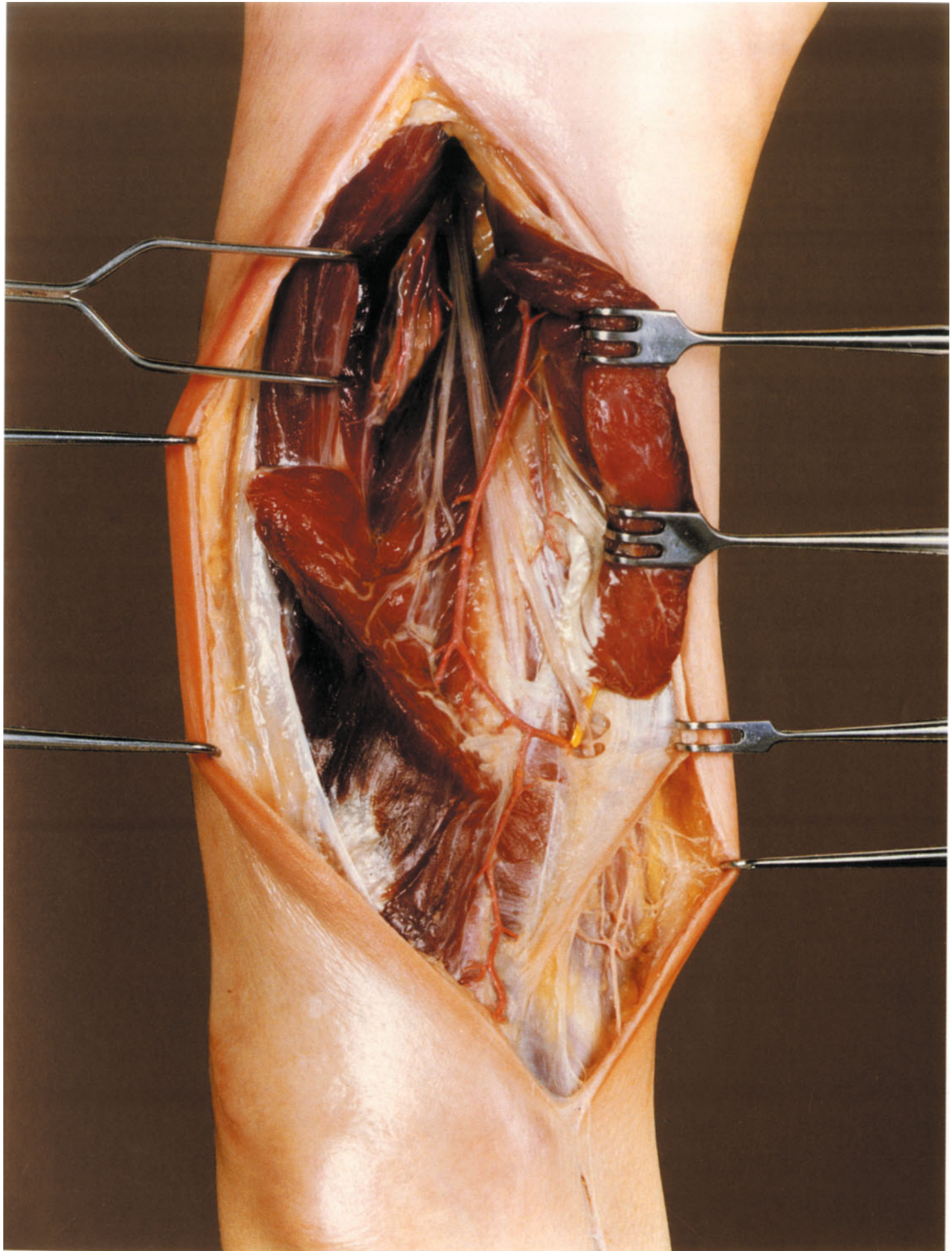


The **lateral head** of the **triceps brachii muscle** has been transversely divided and reflected, exposing a canal that is most aptly termed the **radial canal**. The **lateral head** of the triceps brachii muscle converts the **radial groove** of the humerus into a closed canal that transmits the **radial nerve** and the **radial collateral artery**.

At the outlet of the canal, a bipartite **tendinous band** from the **lateral head** passes over the **radial nerve** and the large **posterior antebrachial cutaneous nerve** that has arisen from it. Continuing its descent, the radial nerve passes beneath the edge of the **medial head** of the triceps brachii, which arises in that area from the **lateral intermuscular septum**. It then pierces the septum with the origin of the brachioradialis muscle at its base and enters the space between the **brachioradialis** and the **brachialis muscles**. Through the superficial opening in the tendinous band, the **posterior antebrachial cutaneous nerve** passes behind the **lateral intermuscular septum** toward the surface and pierces the superficial fascia of the extensor compartment, which is blended with the septum.

The usual, highly simplified description of the **triceps brachii muscle** arising by its lateral head from above the **radial groove** and by its medial head below it, is valid only for the middle third of the humerus – the only part of the bone that bears a radial groove. Above that level, as the dissection shows, the origin of the **medial head** very closely approaches the origin of the **lateral head**, which is on the lateral surface of the humerus and does not extend as far posteriorly as an imaginary extension of the radial groove would indicate.

In the lower third of the humerus as well, the **medial head** of the triceps brachii muscle is placed well laterally as it arises from the **lateral antebrachial septum** interposed between the medial head and the brachioradialis muscle group. The location of this septum is indicated by the retracted attachment of the **superficial fascia** of the extensor compartment of the upper arm.



The flexor group of muscles in the upper arm becomes interposed in the **anterior cubital region** between the flexor group and brachioradialis group of the forearm, forming a **Y-shaped groove** centered on the **cubital fossa**.

The deepest part of the **cubital fossa** lies lateral to the palpable biceps tendon, so it is also lateral to the center of the forearm.

Subcutaneous fat occupies all of the cubital fossa and, in well-nourished individuals, fills most of the grooves that radiate out from the fossa. With the skin removed, the **large venous trunks** that lie in the grooves can be seen through the surface of the subcutaneous tissue and, when congested, appear very prominent.

The surface of the **subcutaneous tissue** bears a network of smaller veins that lie against the deep surface of the skin. This **superficial subcutaneous venous network** drains primarily to the deep venous trunks of the cubital fossa through moderately large veins in the middle layer of the subcutaneous tissue.

This dissection illustrates the general principle that the **caliber** of the **subcutaneous veins** increases markedly from the surface to the deep part of the subcutaneous tissue, the **large venous trunks** themselves lying at variable depths, as the figure shows. Most superficial are the venous trunk in the lateral groove of the elbow and that in the medial groove in front of the biceps tendon.

The relation of the subcutaneous veins to the superficial fasciae is described in Figs. 151–153.



The **variability** of the large venous trunks in the anterior cubital region has led to various interpretations of the regional venous anatomy and various names for venous segments. This clarified specimen depicts an **intermediate pattern** between the possible extremes and illustrates a distinct **median cephalic vein** and **median basilic vein**.

The **median cephalic vein** and **median basilic vein** lie in the grooves lateral to the flexor group of the upper arm that are continued into the **cubital fossa** from the **lateral bicipital sulcus** and **medial bicipital sulcus**.

These two venous trunks arise from the division of the **median antebrachial vein** (median vein of the forearm) and end in the **cephalic vein** and the **basilic vein**. This creates an **M-shaped pattern** with a relatively upright radial limb, because the deepest part of the cubital fossa lies radial to the biceps tendon and is the site where the **median antebrachial vein** bifurcates and receives the **median profunda vein**, which connects it with the deep veins. In this case one branch of the median profunda vein passes between the biceps tendon and bicipital aponeurosis to the **venae comitantes** of the brachial artery while the other branch connects with the **venae comitantes** of the radial artery.

The cephalic vein and basilic vein are derived mainly from the **dorsal venous network** of the **hand**. The **cephalic vein** ascends along the lateral border of the forearm to the **lateral bicipital sulcus** while the **basilic vein** winds forward along the medial border of the forearm to the **medial bicipital sulcus**.

The **superficial venous drainage** of the forearm does not always show this degree of symmetry. The **median cephalic vein** may contribute much less drainage to the cephalic vein, in which case the **median basilic vein** is the only substantial vein in the cubital fossa and is simply called the **median cubital vein**.

The dark spots on the vascular branches indicate the cross sections of veins, that connected the superficial venous network with the deeper veins.



The **subcutaneous tissue** in the **medial bicipital sulcus** has been removed down to the deep layer of the stratum subcutaneum, leaving intact a fatty layer that is traversed by the **basilic vein** and the **medial antebrachial cutaneous nerve**. The **deep layer of stratum subcutaneum** covering these structures can be traced distally over the large veins and larger cutaneous branches, where it forms the roof of fat-filled **flat tunnels**. Since this fatty layer anchors the veins, its absence in a fat-depleted arm accounts for the “rolling veins” phenomenon that occurs with attempted venipuncture. The deep layer of the stratum subcutaneum is a very thin connective tissue layer through which the deep venous trunks can be seen.

The **deep layer of the stratum subcutaneum** alongside the flat tunnels blends with the **superficial fascia** or forms connective tissue sheets that accompany structures passing to the skin from deeper levels (as described in the Introduction to Volume I).

The superficial venous anatomy in this arm is somewhat different from that in Fig. 150. The **cephalic vein** is not joined at the typical site by the **median cephalic vein**, which here is considered part of the cephalic vein because it connects with the origin of that vein via the **median antebrachial vein**. The median basilic vein in this specimen arises directly from the cephalic vein, forming a **median cubital vein** that joins the basilic vein. Before entering the basilic vein, it receives the transposed **median antebrachial vein**, which almost seems to duplicate the basilic vein in the forearm. Accordingly, the veins draining the peripheral venous plexuses spiral from a posterolateral to antero-medial position as they ascend.

One difficulty with this interpretation, which conforms to GRAY’s Anatomy, is that the **median cephalic vein** and **median antebrachial vein** have become part of an entirely different vessel, while a venous segment occupying the classic position of the cephalic vein must be called the **accessory cephalic vein**. Several similar variations will be discussed in subsequent figures.



The **median basilic vein** is exposed through an oblique skin incision that starts a full fingerwidth above and slightly anterior to the **medial epicondyle** of the **humerus** and is directed toward the deepest part of the **cubital fossa** lateral to the palpable biceps tendon.

Dividing a **subcutaneous tissue** layer of variable thickness exposes the **deep layer of the stratum subcutaneum**, which in this area forms the roof of a flat tunnel transmitting the median basilic vein. In well-nourished individuals, fatty tissue flanks the vein within the tunnel and also accompanies the branches of the **medial antebrachial cutaneous nerve**.

The **medial antebrachial cutaneous nerve** at this level has already divided into its **anterior branch** and **posterior branch**, which may cross over or under the vein. But even the anterior nerve branch is so far posterior that it can appear only in the upper angle of the incision. Smaller **collateral branches** of the **medial antebrachial cutaneous nerve** sometimes occur medial to the nerve's anterior branch; they may enter the field of the dissection by crossing in front of the vein.

Lateral to the biceps tendon, the vein lies anterior to the **bicipital aponeurosis** (formerly the **lacertus fibrosus**), which is covered by a transparent continuation of the **superficial brachial fascia** that forms the floor of the flat tunnel.

An experienced examiner can determine by **vein compression** and **palpation** whether a serviceable vein (i.e., large enough for venous access) is available at the designated site.



The **subcutaneous veins** and **nerves** have been dissected out of their flat tunnels by removing the tunnels roofs (formed by the **deep layer of the stratum subcutaneum**) and clearing the tunnels of fatty tissue. The **floors** of the tunnels, consisting of **superficial fascia**, have been left intact.

The **superficial brachial fascia** has been opened over the **biceps brachii muscle**. Several streaklike tendinous extensions from the reflected fascial flap pass beneath the large venous trunks to the **common head** of the **flexors**, where they blend with the fascia supplementing the skeletal attachments of that muscle group and connect distally with the **superficial antebrachial fascia**.

The fascia over the **aponeurosis** of the **biceps brachii muscle** (the **bicipital aponeurosis**) forms a layer that remains separate until it becomes attached to the common head of the flexors.

The fascia above the **medial epicondyle** and **pronator teres muscle** origin is attached to the **medial intermuscular septum** of the arm. It is continuous posteriorly with the fascia covering the **triceps brachii muscle**.

Anterior to the **medial intermuscular septum**, the **superficial brachial fascia** forms the floor of a flat tunnel that separates the **basilic vein** from the brachial artery (with its *venae comitantes*) and the median nerve.

The **antebrachial cutaneous nerve**, with its anterior and posterior branches, also descends in the flat tunnel that transmits the **basilic vein**. The **anterior branch** in this specimen descends on the surface of the vein, where it splits into two additional branches.

The **venous valves** appear as slight bulbous expansions in the vein walls, mostly occurring proximal to the union of two branches. The branch pattern in this specimen was interpreted in Fig. 152.



Panel A shows a **typical M-shaped branch pattern** of the subcutaneous cubital veins. This pattern, marked by the presence of a median cephalic vein and median basilic vein, conforms to that shown in **Fig. 150**. Several longitudinal veins of the middle layer connect the veins of the resected superficial layer with the deep veins.

The **cutaneous nerves** have been retracted from the opened flat tunnels with threads. On the lateral side of the biceps tendon, the **lateral antebrachial cutaneous nerve** appears in front of the brachialis and below a fascial arch between the biceps brachii and brachioradialis muscles. The anterior division of the anterior branch of the **medial antebrachial cutaneous nerve** has been retracted forward and the posterior branch backward.

In **Panel B**, the median veins unite at a considerably more proximal level while the venous plexuses of the anterior forearm are drained by a posteriorly placed **median antebrachial vein** that drains into the basilic vein. This pattern is more like that described in **Fig. 151**, with the cephalic vein showing an intermediate type of placement.

The **basilic vein** and its tributaries are thrombosed due to intravenous injections, making them incompetent for venous drainage. But the interconnections among the superficial venous plexuses and their connections with the deep veins can adequately compensate for this deficiency.

The **cephalic vein** in **Panel D** is poorly developed. It replaces the transposed **median antebrachial vein** in the forearm and drains into the **median basilic vein**, which here is called the **median cubital vein** because it is the only substantial median vessel. It is joined by the transposed **median antebrachial vein** and receives retrograde drainage from the upper arm via the cephalic vein. The termination of the cephalic veins is retracted with a thread, displaying their connection to the deep veins via a **median profunda vein**.

The **superficial brachial fascia** has been opened to show the relationship of the median cubital vein to the **brachial artery** and one of its **venae comitantes**.

Panel C presents a medial view of a typical arrangement of the cubital veins in a very **thin arm** with poor muscular development and large veins. This specimen illustrates that the diameter of the subcutaneous veins is not determined by the volume of the arm.



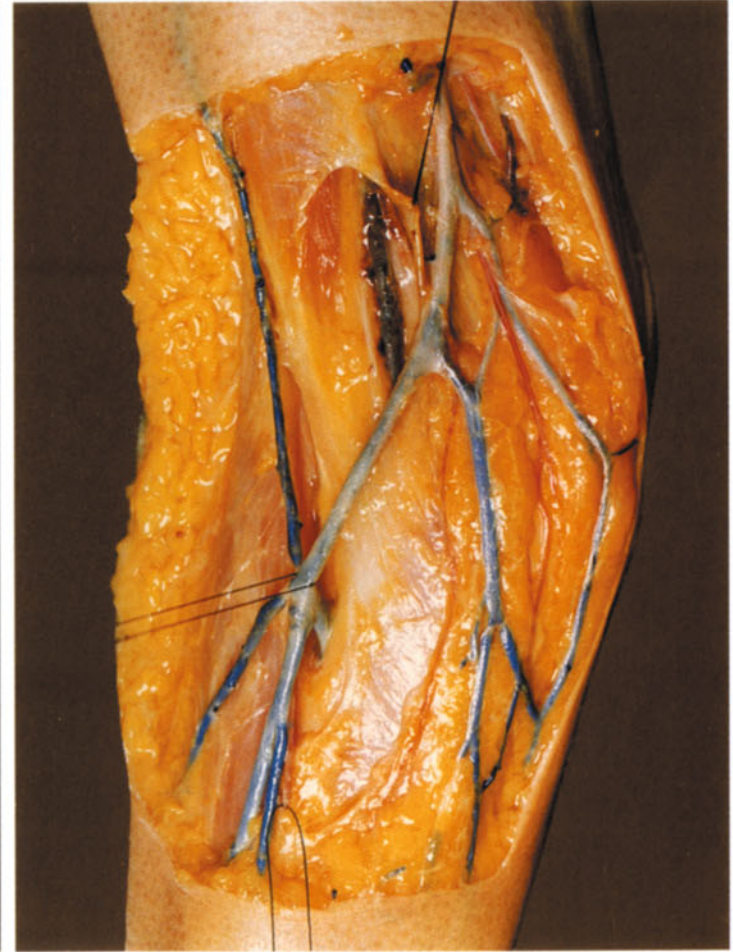
A



B



C



D

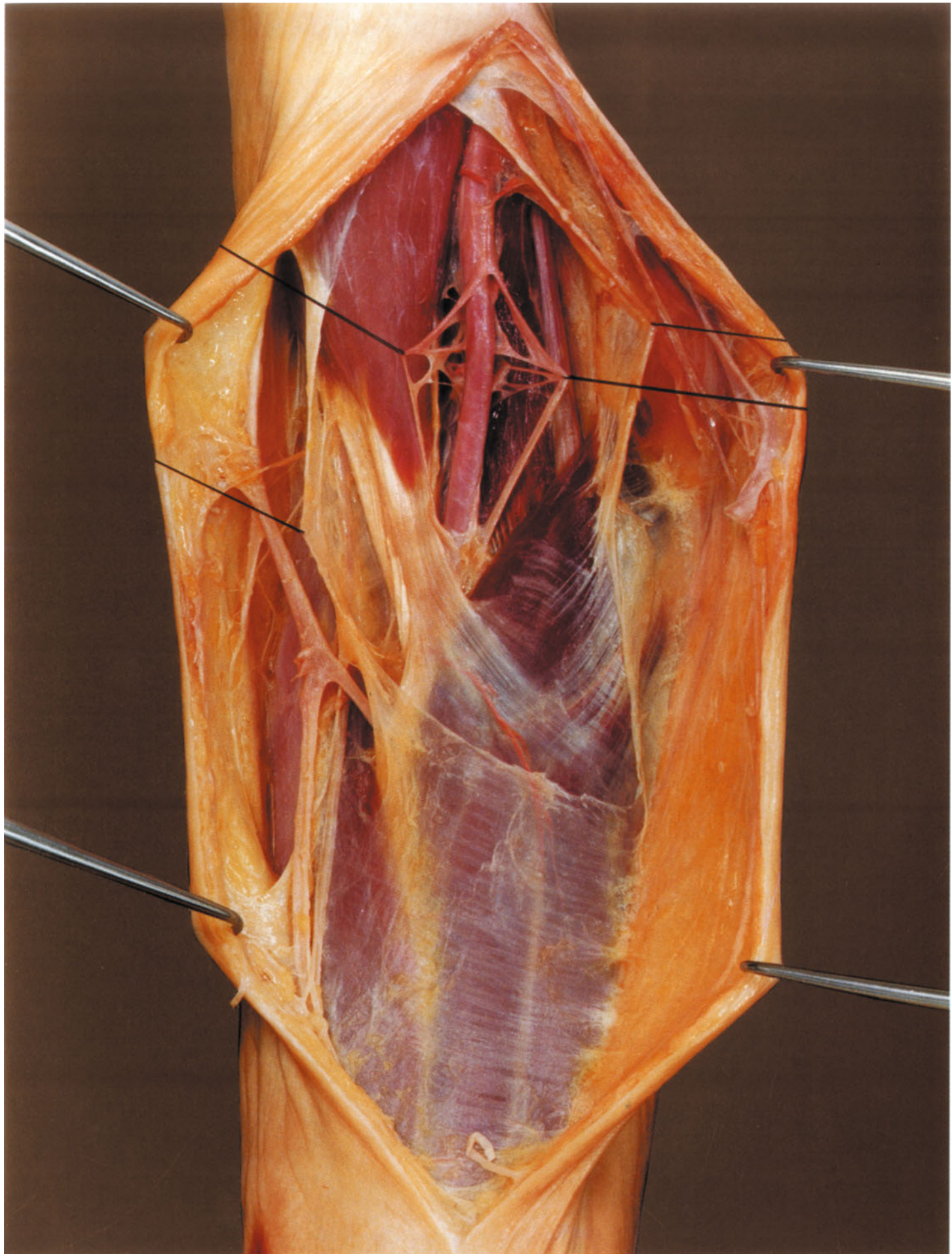
The **median basilic vein** has been isolated and divided, and the **superficial fascia** has been longitudinally incised and retracted, exposing the **biceps brachii muscle**. The **bicipital aponeurosis** extends from the **biceps tendon** to the **common head** of the **flexors**. The **brachial artery** descends along the medial border of the muscle, disappears behind the bicipital aponeurosis, and enters the depths of the cubital fossa medial to the biceps tendon.

The **brachial artery** is accompanied by two interwoven **venae comitantes**. A vascular sheath, incised longitudinally but left intact proximally, maintains the close relation of the veins to the brachial artery. This vascular bundle lies posteriorly on the **brachialis muscle**, whose medial border is behind the **median nerve**. Medial to the brachialis muscle is the **medial intermuscular septum**, to which the retracted **superficial brachial fascia** is attached.

Anterior to this part of the fascia lies the opened, fat-filled **flat tunnel** that transmits the **basilic vein**. This tunnel is still covered by a remnant of the **deep layer of the stratum subcutaneum**, which forms two layers between which the **anterior branch** of the **medial antebrachial cutaneous nerve** passes toward the surface.

On the opposite side of the field, the **flat tunnel** for the **cephalic vein** has been opened and the vein retracted with the skin. The **superficial fascia** passes around the lateral border of the biceps tendon to connect with the fascial layer covering the brachialis muscle. A **fascial arch** extends from it to the **brachioradialis muscle**, and below that is the **lateral antebrachial cutaneous nerve**, which was enclosed in a common flat tunnel along with the median antebrachial vein.

Lateral to the biceps tendon, the **median profunda vein** passes deeply from the retracted junction of the median cephalic and median basilic veins.



The skin and subcutaneous tissues have been mobilized and retracted, and all of the **superficial fascia** has been removed. Medial retraction of the **pronator teres muscle** has opened up the **cubital fossa**, exposing the **brachial artery** in its descent between the **bicipital aponeurosis** and **biceps tendon**. The brachial artery is anchored very firmly in this region and, on flexion of the elbow, bends sharply above the origin of the radial artery. Maximum flexion compresses that portion of the artery, interrupting most of the blood supply to the forearm. The **radial pulse** is lost, and extreme flexion (“ADELMANN’S flexion”) can provide temporary hemostasis in the forearm.

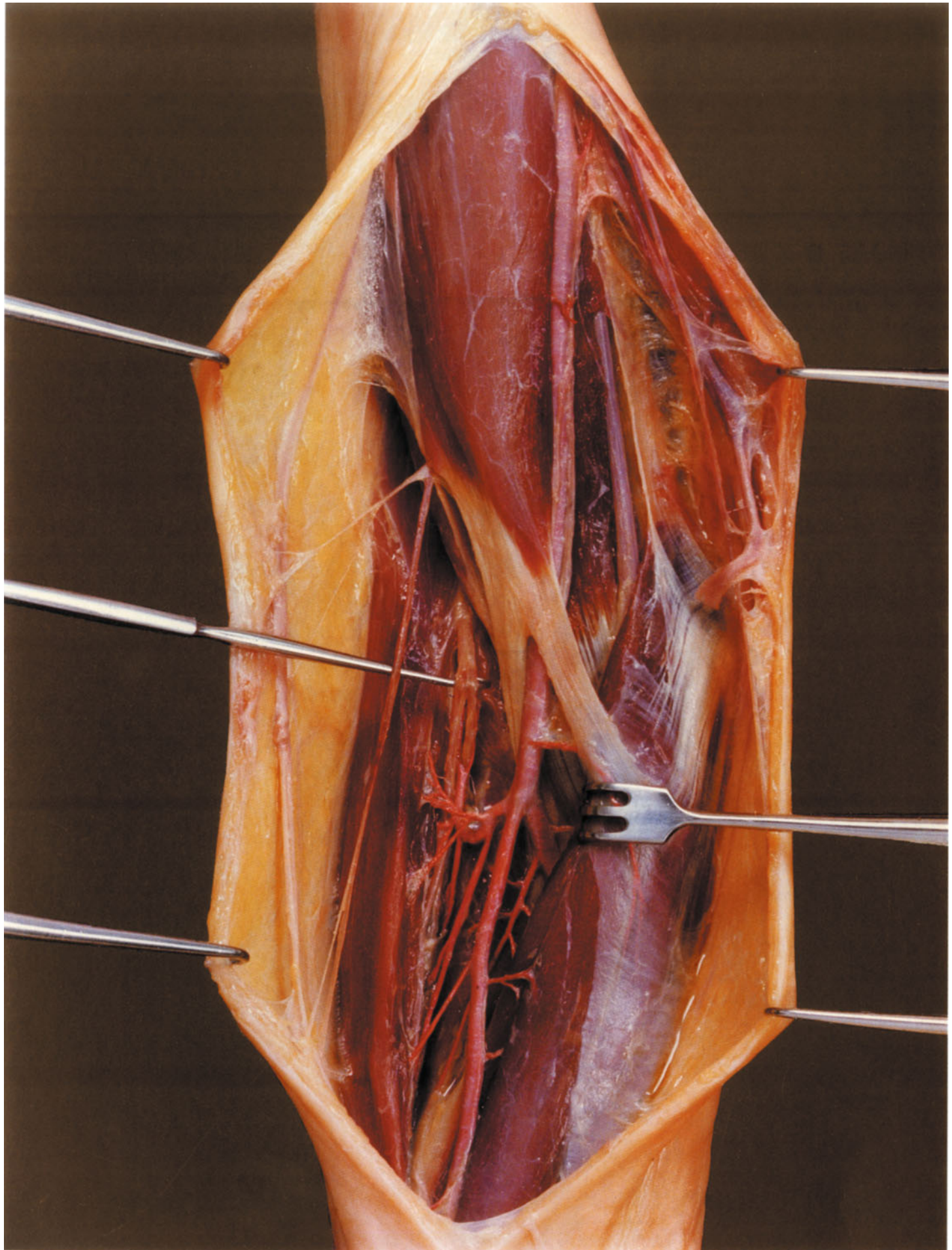
The **radial artery** crosses superficial to the insertion of the **pronator teres muscle** and runs distally in the **radial sulcus** of the forearm between the flexors and extensors. Just past its origin it gives off the **radial recurrent artery**, which ascends along the **radial nerve** and anastomoses with the **anterior branch** of the **radial collateral artery**.

The **radial nerve**, having entered the area between the **brachioradialis** and **brachialis muscles**, divides into a **superficial branch** and a **deep branch** at the point where the nerve is elevated on a hook.

Superficial to the **radial nerve**, the **lateral antebrachial cutaneous nerve** has left the plane between the **brachialis** and **biceps muscles** after supplying both with motor fibers.

The **median nerve** diverges markedly from the **brachial artery** above the **bicipital aponeurosis**, the artery following the border of the **biceps muscle** while the nerve follows the **lateral intermuscular septum**.

The **basilic vein** and **medial antebrachial cutaneous nerve** are visible on the deep surface of the medial skin flap, and the **cephalic vein** is visible on the lateral skin flap.



The **bicipital aponeurosis** has been divided, allowing the **cubital fossa** to be opened further. The **humeral head** of the **pronator teres muscle** has been drawn medially with two retractors, displaying its origin up to the **medial intermuscular septum** and its **ulnar head**.

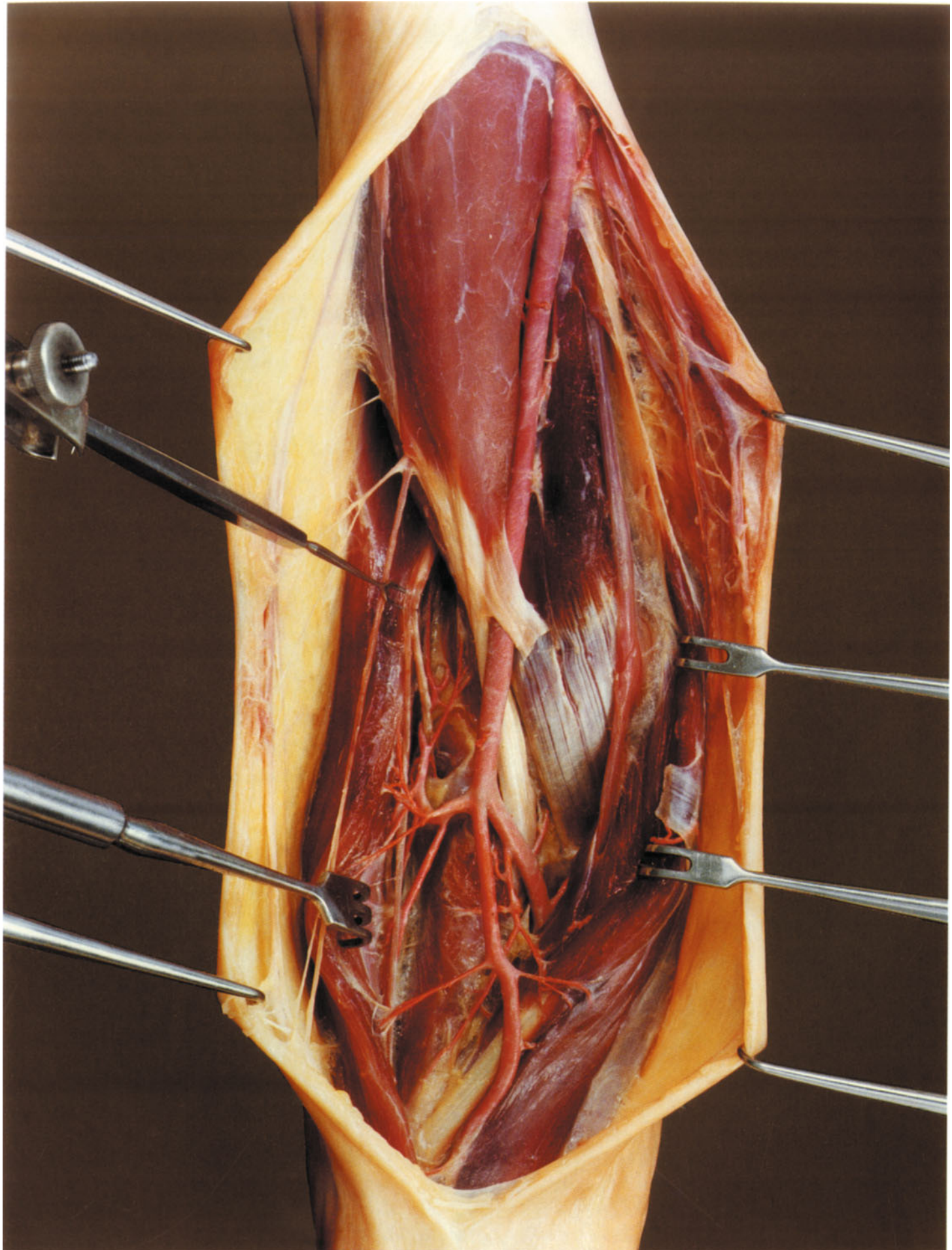
The **median nerve** leaves the cubital fossa between the **humeral head** and **ulnar head** of the pronator teres muscle. Lateral to the nerve, the **brachial artery** passes below the barely visible upper border of the **flexor digitorum superficialis muscle**, whose lateral part is attached to the ulna by a tendinous slip, the **humero-ulnar head** of the muscle.

Medial to the biceps tendon, the **brachialis** fibers converge to a broad, flat tendon that is attached to the **ulnar tuberosity**. The muscle also has an origin on the **medial intermuscular septum**, and anterior to it is the **median nerve**.

The **brachioradialis muscle** has been widely retracted on the lateral side, opening up the groove between it and the **brachialis muscle** and exposing part of the **anterolateral surface** of the **humerus**. The **radial recurrent artery** runs proximally within the groove, and the **radial nerve** descends in front of the artery. The **radial nerve** has been pulled forward with a hook, placing tension on its two terminal branches. The **deep branch** enters the interval between the planes of the **supinator** fibers while the **superficial branch** accompanies the **brachioradialis muscle**, crossing behind it in the middle third of the forearm.

Narrow strips of the **brachialis muscle** can be seen lateral to the **biceps** and its tendon, and the **brachioradialis muscle** has been retracted away from its area of contact with the brachialis muscle. This area is continuous with a connective-tissue ridge that extends to the base of the biceps tendon. There the brachioradialis muscle acquires a rounded surface that forms the lateral boundary of the cubital fossa. Another ridge farther down the brachioradialis muscle runs medially and forms the lateral border of the **radial sulcus** of the forearm.

Retraction of the brachioradialis muscle group has exposed the **supinator muscle**, and the tendon of insertion of the **biceps brachii muscle** is visible as far as the radial tuberosity.



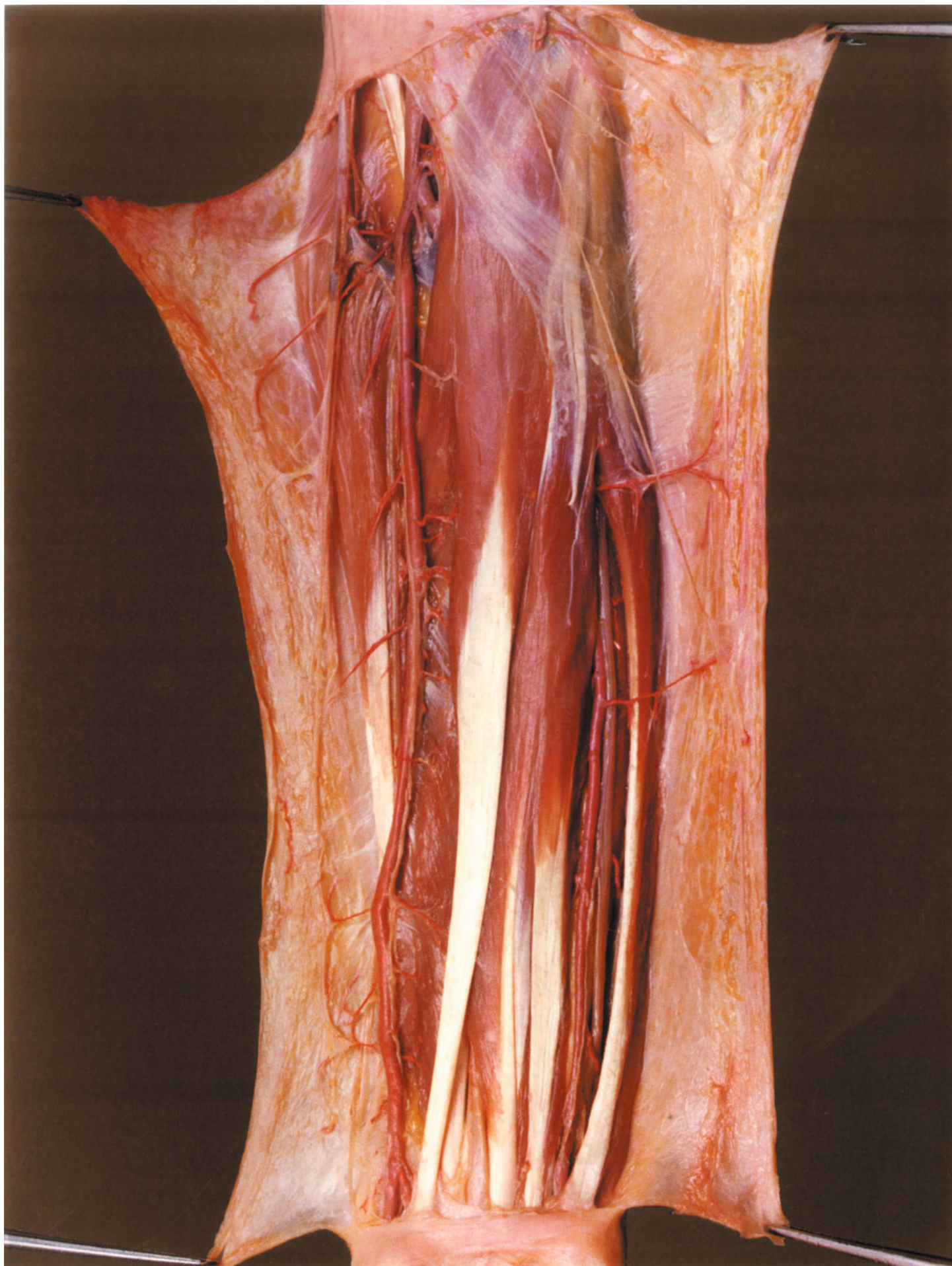
As in other limb segments, the proximal boundary of the anterior antebrachial region does not conform to the full proximal extent of the forearm: while the **forearm** (antebrachium) extends from the middle of the elbow to the distal end of the forearm bones, the **anterior antebrachial region** starts distal to the **anterior cubital region**, marked by an arbitrary boundary line drawn between the insertions of the **biceps brachii muscle** and **pronator teres muscle**.

The skin, or **common integument**, has been reflected back and the **superficial antebrachial fascia** removed in areas where it does not supplement the skeletal attachments of the muscles. The spaces between the muscle planes, here isolated by dissection, form two pathways – a **radial track** and an **ulnar track** – that transmit neurovascular structures down the forearm toward the hand.

The **radial track** lies between the **brachioradialis muscle** and **flexor carpi radialis muscle**. Its floor is formed by the insertion of **pronator teres**, the origin of the **radial head of flexor digitorum superficialis**, and by **flexor pollicis longus** and **pronator quadratus**. It is traversed by the **radial artery** and its accompanying veins. The **superficial branch** of the **radial nerve** also follows this track until it passes deep to the brachioradialis tendon and crosses to the dorsal side. The superficial correlate of the radial track is the **radial sulcus** of the forearm.

The **ulnar track** lies between the **flexor carpi ulnaris** and **flexor digitorum superficialis muscles**, and its floor is formed by the **flexor digitorum profundus muscle**. It transmits the **ulnar nerve** and **artery** with its *venae comitantes*.

The **median nerve** takes its own path between the **flexor digitorum superficialis** and **profundus muscles** and appears radial to the tendons of flexor digitorum superficialis. When a **palmaris longus muscle** is present, the nerve lies between that muscle's tendon and the tendon of **flexor carpi radialis**, both of which are clearly palpable in most cases.



The radial and ulnar tracks have been opened more widely to better demonstrate the floors of both tracks. The **flexor carpi ulnaris muscle** bordering the **ulnar track** has been retracted medially, displaying its deep surface almost to its origin from the posterior border of the ulna. This also exposes the **flexor digitorum profundus muscle**, which encloses and conforms to the ulnar surface anterior to its border. In the distal part of the opened track, the muscle ends in **tendons** for the ulnar fingers.

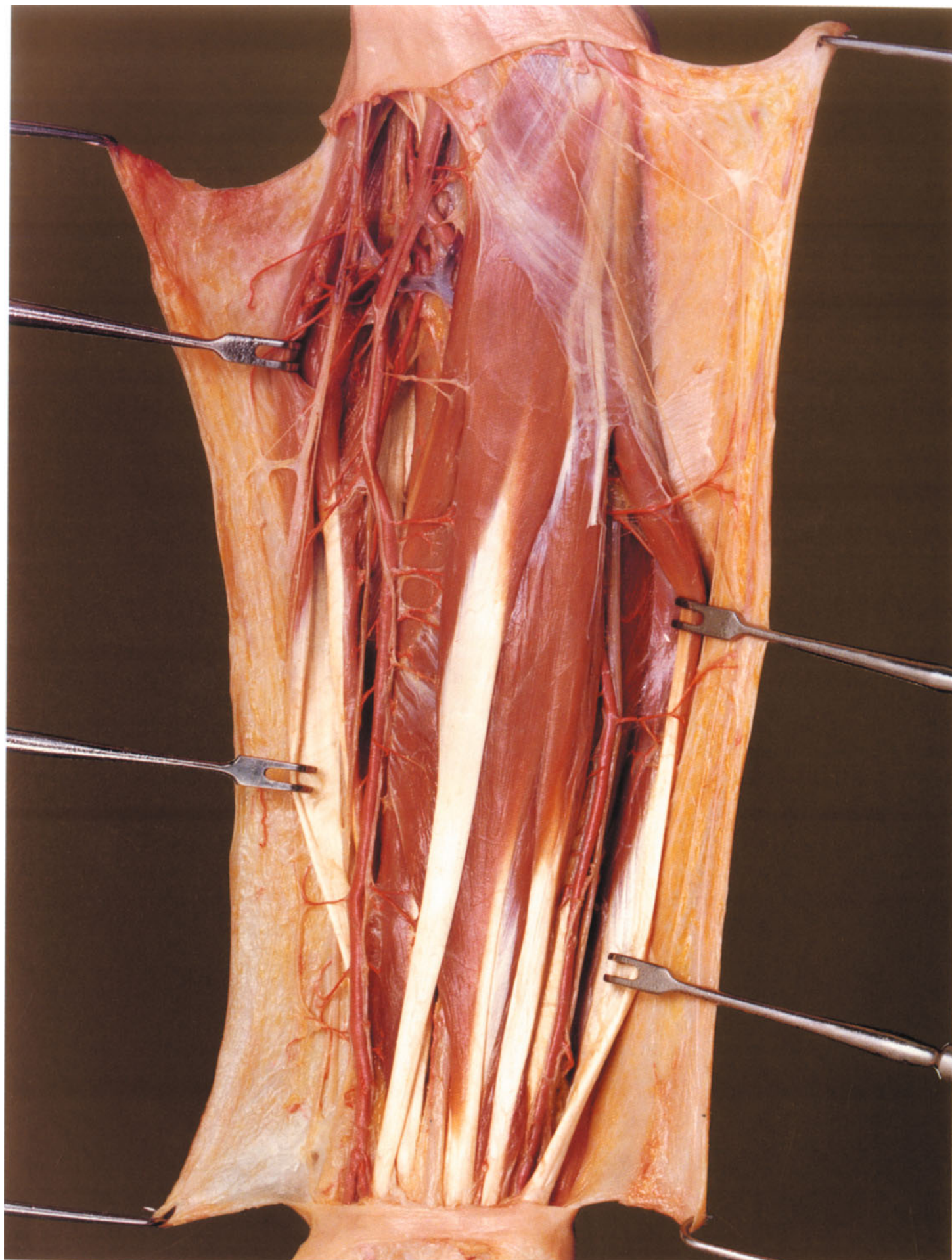
The **ulnar nerve**, which follows the **flexor carpi ulnaris muscle** from the elbow along the medial side of the forearm, can be located in the distal two-thirds of the forearm without having to dissect the muscles. At about the middle of the forearm, it is joined in its course by the **ulnar artery** with its accompanying veins. Shortly thereafter it gives off its **dorsal branch**, which passes behind the flexor carpi ulnaris tendon to the dorsum of the hand.

To open up the **radial track** on the lateral side of the forearm, the **brachioradialis muscle** and its tendon have been retracted from the **extensor carpi longus** and **brevis**, and the latter from the **supinator muscle**, exposing the deep tendinous expansion of the **extensor digitorum communis**.

On the **floor** of the radial track, the **pronator teres muscle** is succeeded distally by the **radial head** of the **flexor digitorum superficialis**, which overlaps the **flexor pollicis longus**.

The **lateral head** of the **flexor digitorum longus muscle** ends in the tendon for the middle finger. This tendon and the tendon for the ring finger are more superficial than the other two flexor digitorum tendons. Just radial to the tendons for the index and middle fingers is the **median nerve**, which in turn is adjoined by the tendon of the **flexor pollicis longus**. The tendon for the little finger is sometimes rudimentary.

The **palmaris longus** is a highly variable muscle that is sometimes absent. Its rudimentary tendon has been resected in this specimen.



The **brachioradial muscle group** has been widely opened and elevated from the radius (still covered by the **supinator muscle**), forming a deep cleft extending to the common deep aponeurosis of the **extensor carpi radialis brevis** and **extensor digitorum muscles**.

The **radial artery** follows the lateral musculature proximal to the insertion of **pronator teres**, this segment of the artery supplying numerous **muscular branches** exclusively to the lateral muscles. Distal to the insertion of pronator teres, the artery also distributes muscular branches to the flexors of the forearm. This change from unilateral to bilateral tethering of the artery accounts for its bayonet-like angulation in the middle third of the forearm.

The **radial recurrent artery** arises from the radial artery in the interval between the **brachioradialis muscle** and **brachialis muscle**, passes upward along the radial nerve, and anastomoses with the **anterior branch** of the **radial collateral artery**.

The **radial recurrent artery** distributes large **muscular branches** to the brachioradial muscle group and is adjoined by a large vein, the **median profunda vein**, that communicates with the deep veins of the arm.

Above the origin of the radial recurrent artery, the **radial nerve** has already divided into its deep and superficial branches. The **deep branch** enters the **supinator muscle** while the **superficial branch** descends on the deep surface of **extensor carpi radialis longus** and **brevis** and exits the radial track between the tendons of the **brachioradialis** and **extensor carpi radialis longus**. Its initial portion is still accompanied by the **muscular branch** for the **extensor carpi radialis brevis**.

The retraction of the **pronator teres muscle** exposes the site where the **median nerve** and **brachial artery** leave the cubital fossa to enter the plane deep to the **flexor digitorum superficialis muscle**.

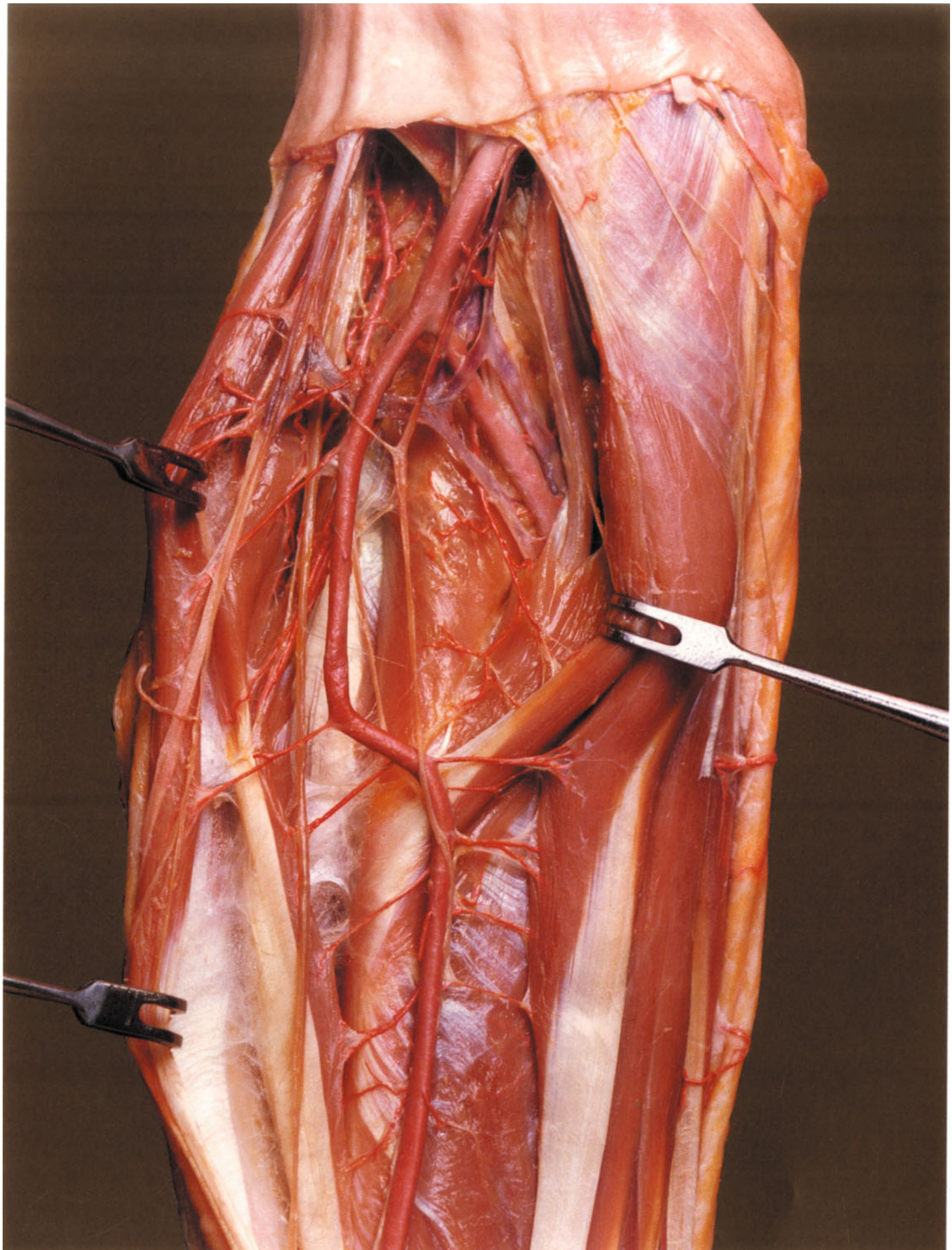


Figure 161**Antebrachial Region 4
Superficial Layer 4
Flexor Digitorum Superficialis Muscle**

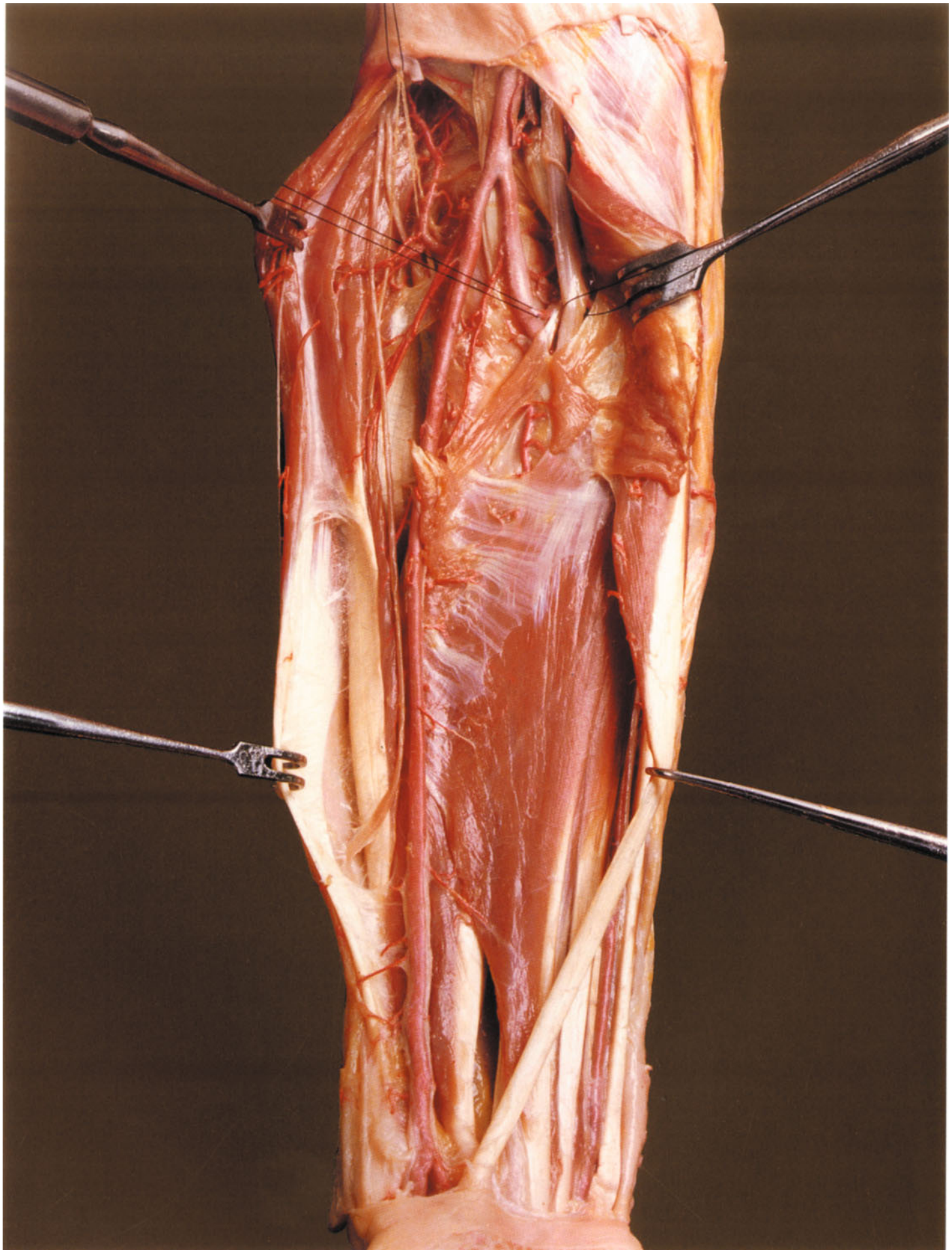
With the **humeral head** of the **pronator teres muscle** divided at its insertion and reflected medially, we can see an aponeurosis between the **pronator teres**, **flexor carpi radialis**, and **flexor digitorum superficialis muscles** that forms part of the superficial origin for the humeral head of pronator teres. Its proximal origin has also been divided and reflected medially.

Musculotendinous structures pass upward along, and blend with, the lateral border of the **aponeurosis** and end in a slip that reaches the ulna lateral to the **brachial artery** and attaches distal to the ulnar tuberosity. This slip is the modest ulnar origin of the **humero-ulnar head** of the **flexor digitorum superficialis muscle**. It is overlapped by, and adherent to, the intact **ulnar head** of the **pronator teres muscle**.

The **median nerve** enters the forearm between the **ulnar head** and **humeral head** of the **pronator teres muscle** and passes deep to the common **aponeurosis** that connects pronator teres with flexor digitorum superficialis. Like the brachial artery, then, it passes beneath the portion of the **flexor digitorum superficialis muscle** that arises from the aponeurosis.

The gap that exists between the upper border of the **flexor digitorum superficialis** and the **ulnar head** of the **pronator teres** in this specimen may be occupied by a tendinous arch that, when present, is usually very tenuous. The arch stretches from the **medial epicondyle** of the **humerus** to the **radius** at the upper border of the **radial head** of **flexor digitorum superficialis**. It is normally adherent to the **ulnar head** of **pronator teres**.

The **muscular branches** of the **radial nerve** for the **extensor carpi radialis brevis** and **supinator muscles** are elevated with a thread. Its **deep branch** disappears behind an aponeurotic expansion of the extensor carpi radialis brevis in the supinator.



The **radial head** of the **flexor digitorum superficialis muscle** has been incised longitudinally almost to its distal end, exposing the **median nerve** between the flexor digitorum profundus and flexor digitorum superficialis muscles. It is accompanied in this case by a substantial **median artery** – an ontogenically and phylogenically old vessel that usually regresses but sometimes maintains its connection with the superficial palmar arch.

Distal to the point where the **median nerve** has been snared between the **ulnar head** and **humeral head** of the **pronator teres muscle**, the nerve passes to the deep surface of the **aponeurosis** connecting pronator teres to flexor digitorum superficialis. There it crosses over the **ulnar artery**, which has arisen from the brachial artery. At a more proximal level, the brachial artery emerges between the ulnar head of pronator teres and the ulnar attachment of the **humero-ulnar head** of **flexor digitorum superficialis**, having first given off the **ulnar recurrent artery**, which has been snared with a thread.

Retraction of the **brachioradialis muscle** has exposed a considerable length of the **extensor carpi radialis longus**. The branches of the **radial nerve** descend along the medial side of this muscle, and farther medially the **radial recurrent artery** ascends along the anterolateral surface of the humerus before anastomosing with the **anterior branch** of the **radial collateral artery**.

A thread has also been placed around the **radial nerve branches** to the **extensor carpi radialis brevis** and **supinator muscles**. The supinator branch and the **deep branch** of the **radial nerve** enter the interval between the **superficial** and **deep parts** of the **supinator muscle**, which is bounded distally by an expansion of the **extensor carpi radialis brevis tendon** to the supinator muscle.

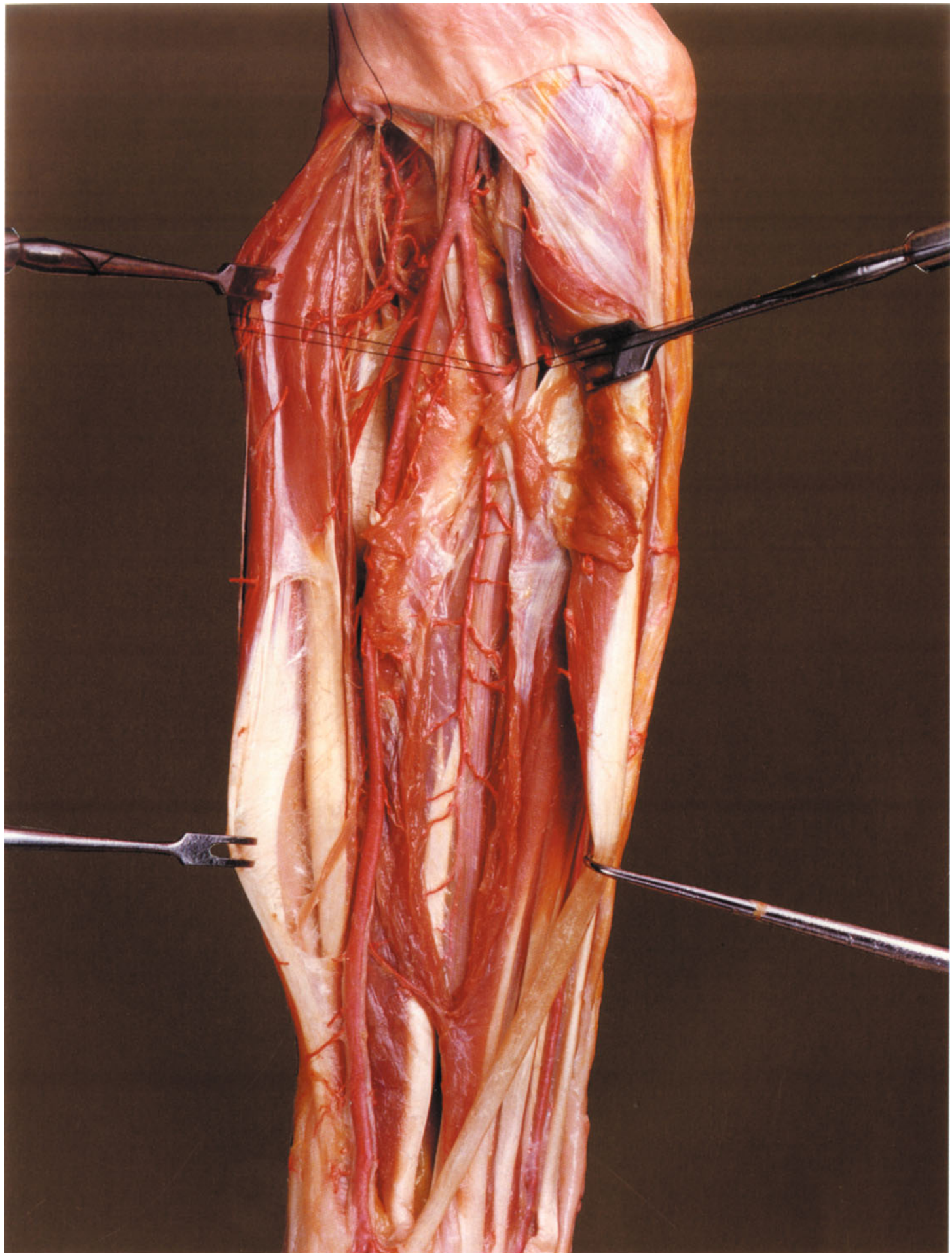


Figure 163**Antebrachial Region 6
Deep Layer 2
Flexor Digitorum Profundus Muscle**

The longitudinal incision through the **radial head** of the **flexor digitorum superficialis muscle** has been completed, and the superficial group of anterior forearm muscles has been retracted medially to expose the deep group.

It can be seen that the tendons of the **flexor digitorum profundus**, unlike those of the **flexor digitorum superficialis**, occupy one plane and, except for the tendon to the index finger, form a continuous sheet that extends far distally.

The **belly** of the **flexor digitorum profundus** for the index finger is fairly well demarcated from the rest of the muscle, although it commonly has connections with neighboring muscles. In this case it is connected by a tendon to the **flexor pollicis longus** and by a muscle bundle to the **flexor digitorum superficialis**. Sometimes these two connections are more isolated, defining a **superior belly** for the **flexor pollicis longus muscle**.

The **anterior interosseous artery** descends on the anterior surface of the interosseous membrane in the distally tapering gap between the **flexor pollicis longus** and **flexor digitorum profundus** muscles. Superficial to **flexor digitorum profundus**, a **median artery** accompanies the **median nerve** in its descent.

The **median artery** is an atavistic vessel. Phylogenically and ontogenically it predates the radial artery and may replace that vessel in contributing to the superficial palmar arch. It distributes numerous branches to the adjacent muscles.

After arising from the brachial artery, the **ulnar artery** crosses beneath the **median nerve** distal to the **ulnar head** of the **pronator teres muscle**. It is then overlapped to an unusual degree by the muscle bundle that interconnects the two digital flexor muscles.

A few centimeters proximal to the wrist, at the site where the **pulse** is normally taken in the arm, the **radial artery** lies upon the **pronator quadratus** (visible medial to the artery) and lateral to the **flexor pollicis longus**.

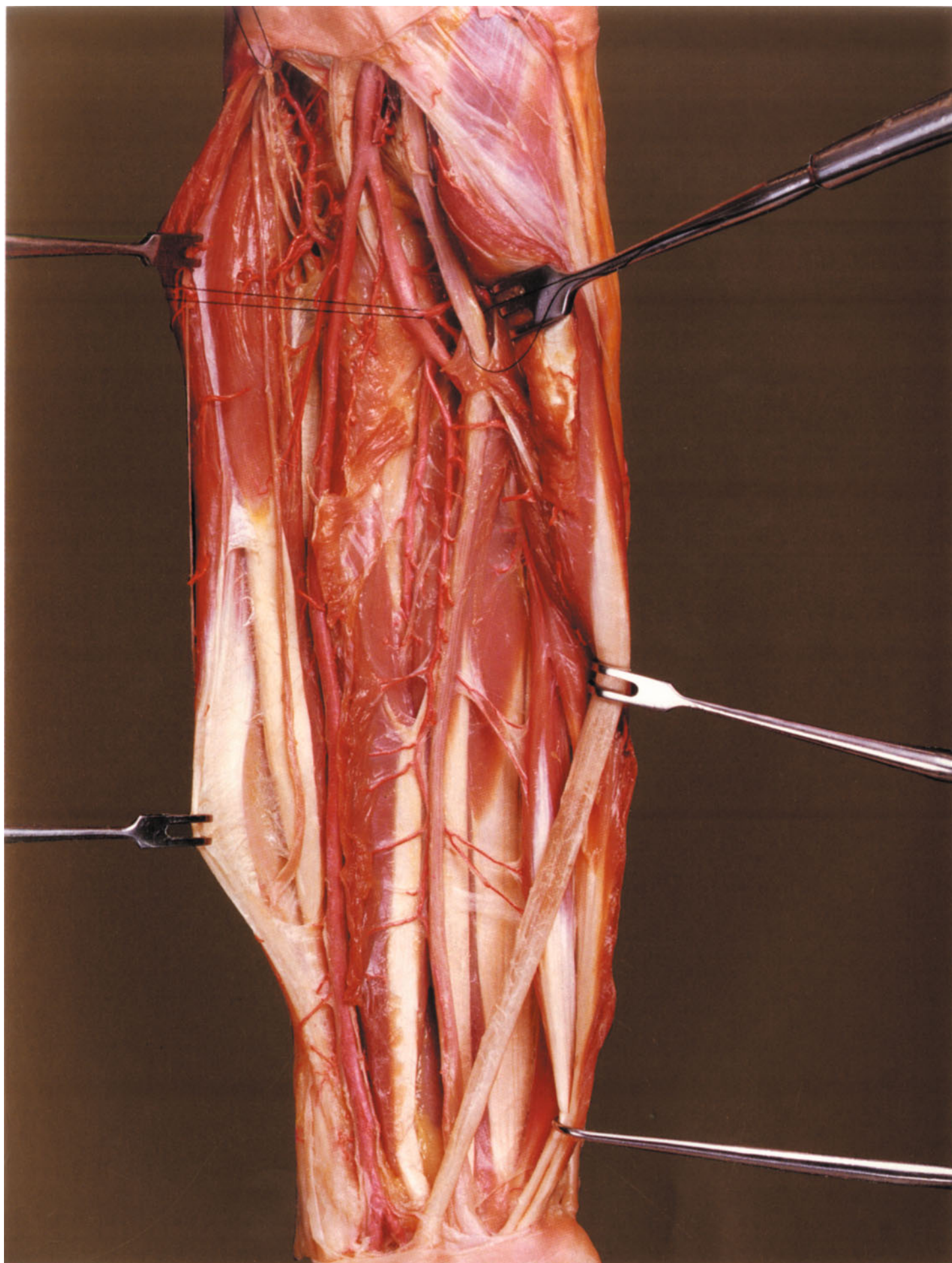


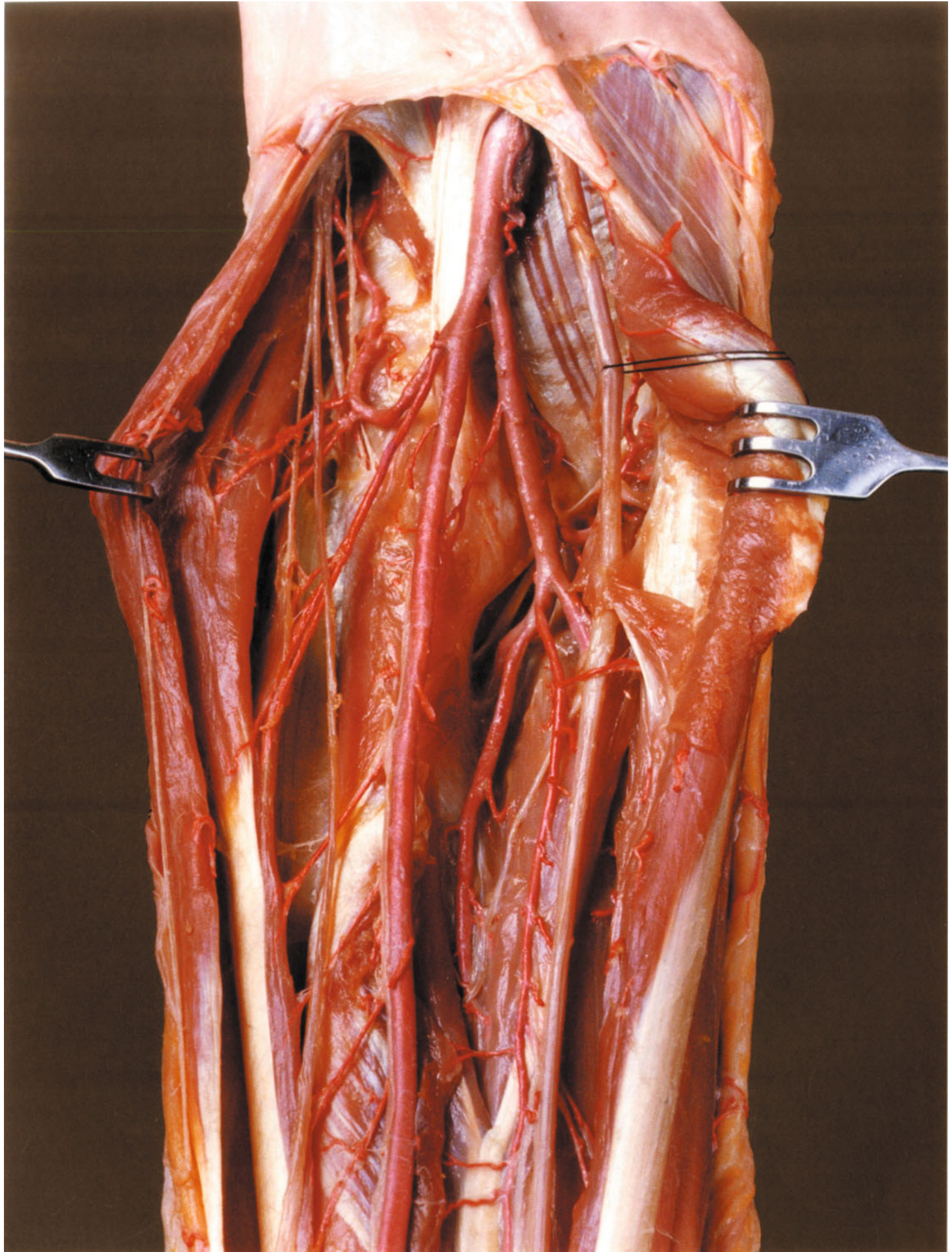
Figure 164**Antebrachial Region 7
Deep Layer 3
Common Interosseous Artery
Recurrent Arteries**

In this closer view of the previous dissection, the **radial head** of the **flexor digitorum superficialis muscle** has been divided and the fibrofatty tissue between the radius and ulna has been cleared from the deepest part of the **cubital fossa**, exposing the division of the **brachial artery** into its two terminal branches. In an atavistic variant, the **common interosseous artery** gives off a well-developed **median artery** that descends a considerable distance with the **median nerve** and distributes numerous branches to the surrounding muscles.

The **common interosseous artery** itself divides into the **anterior** and **posterior interosseous arteries**, which pass distally on opposite sides of the interosseous membrane. The **posterior interosseous artery**, the larger of the two, passes backward between the **oblique cord** and the upper border of the **interosseous membrane** to enter the extensor compartment of the forearm. The **anterior interosseous artery** descends on the front of the **interosseous membrane** near the interosseous border of the radius, passing between the **flexor pollicis longus** and **flexor digitorum profundus muscles**, which in this case are joined together by an intermediate tendon.

A muscle bundle from the **flexor digitorum profundus muscle** to **flexor digitorum superficialis**, formed by fusion of the superior belly of the flexor pollicis longus (which may be absent) with the deep digital flexor, overlies the **ulnar artery** after that vessel crosses beneath the **median nerve**. The artery reappears distally behind the cut edge of the **radial head** of the **flexor digitorum superficialis muscle**, gaining its usual position between the two digital flexors on its way to the **ulnar nerve**. It is covered anteriorly by the reflected **flexor digitorum superficialis muscle**, most of which is hidden by the medially retracted **flexor carpi radialis**.

Before dividing into its terminal branches, the **brachial artery** gives off the **ulnar recurrent artery**, which anastomoses with the ulnar collateral artery via its two branches.



The **anterior carpal region** is a transitional region between the forearm and the hand, which are separated by the **radiocarpal joint** (wrist joint). This region merits closer attention owing to its traumatologic and clinical importance.

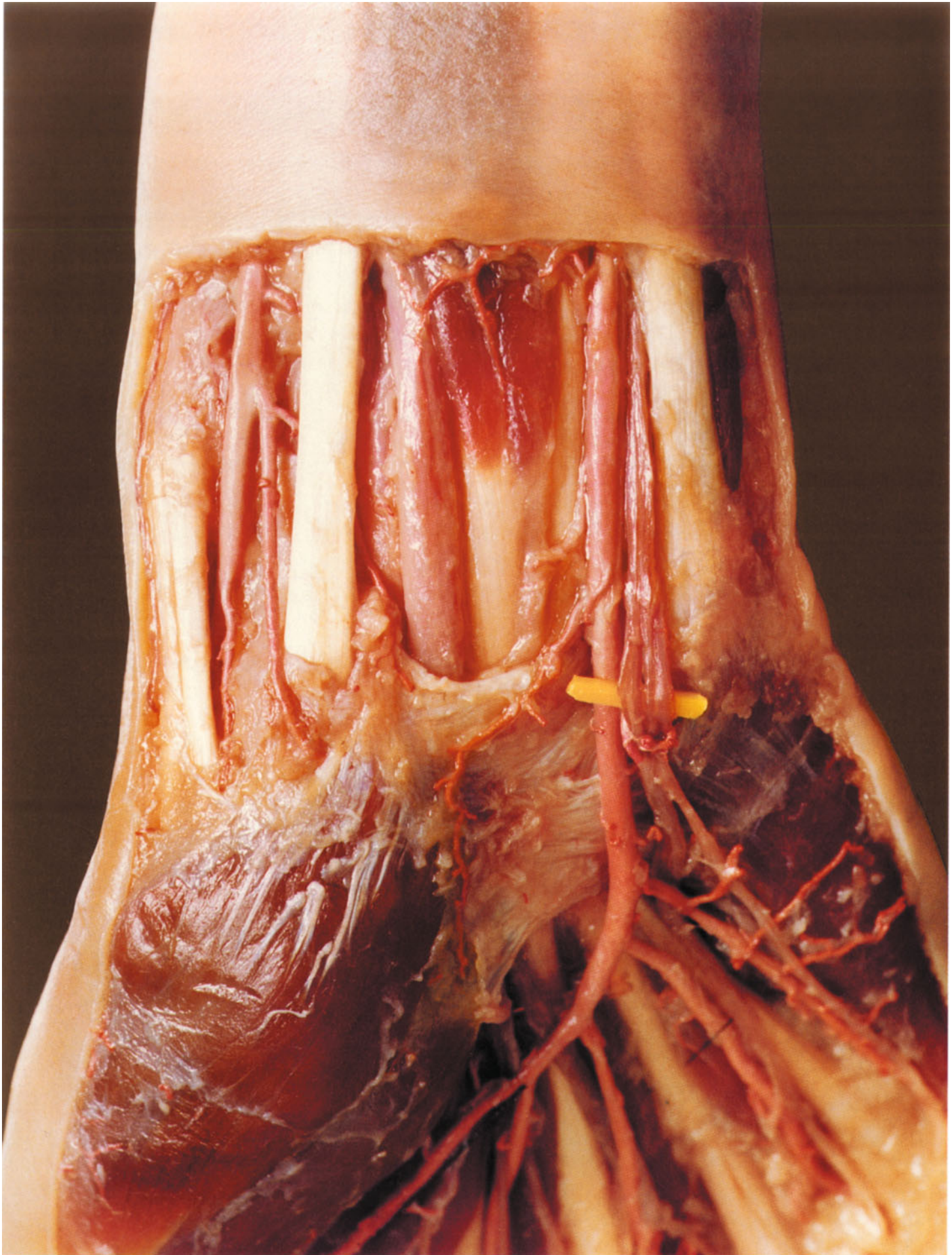
The central structure of this region is the **transverse carpal ligament**, hereafter called the **flexor retinaculum** because of its function. It stretches between the two **carpal eminences** and covers the **carpal groove**, forming the fibro-osseous **carpal tunnel**. Because the walls of the carpal tunnel are firm and inflexible, any expansion of the tunnel contents will cause compression of the median nerve, leading to carpal tunnel syndrome.

Besides the median nerve, the **carpal tunnel** is traversed by the median artery (if present) and by the tendons of the flexor digitorum superficialis, flexor digitorum profundus, and flexor pollicis longus muscles within their sheaths. The arrangement of the tendons proximal to the carpal tunnel was described in Figs. 153 and 159.

The **ulnar nerve** and **ulnar artery** descend along the tendon of the **flexor carpi ulnaris muscle** superficial to the **flexor retinaculum** and give off their branches there. A tag has been placed to mark the division of the nerve into its superficial and deep terminal branches at the level of the **pisiform bone**.

The **flexor retinaculum** is attached on both sides of a groove that is medial to the **tubercle** of the **trapezium** and transmits the **flexor carpi radialis** tendon, creating a canal for that tendon that is separate from the carpal tunnel. A tendon sheath starts within this canal at the base of the second metacarpal bone and continues along the tendon for several centimeters outside the canal, but that portion of the sheath has been removed.

The **radial artery** has been isolated lateral to the **flexor carpi radialis** tendon. It gives off a **superficial palmar branch** that completes the **superficial palmar arch**. This branch passes through the muscles of the thenar eminence but may also pass over them. The radial artery passes beneath the **abductor pollicis longus** and **extensor pollicis brevis** tendons to enter the **radial foveola** (the “anatomic snuffbox”).



The **palmar aponeurosis** lies directly beneath the skin of the **palm** and is connected to it by dense strands of connective tissue. A triangular sheet of tough connective tissue, the palmar aponeurosis divides at its base into four **longitudinal fascicles** that extend to each finger. In the areas where the longitudinal fascicles diverge, the **transverse fascicles** of the deeper, transverse layer of the aponeurosis can be seen.

The **palmar aponeurosis** is generally considered to be an expansion of the **palmaris longus muscle**, but it is always fully developed even in the absence of that muscle, in which case it arises entirely from the **flexor retinaculum**. The palmaris longus tendon, when present, is partially attached to the palmar aponeurosis, while another part of the aponeurosis arises mainly from the distal margin of the flexor retinaculum.

The distal end of the **palmar aponeurosis** is more difficult to display in this superficial dissection. The **longitudinal fascicles** of the aponeurosis have modest lateral extensions alongside a main **central slip** that ends in the transverse skin fold at the base of the fingers and in the underlying fibrofatty tissue. When the metacarpophalangeal joints are fully extended, a small fatty eminence called the **monticulus** appears in the intervals between the slips to adjacent fingers. This occurs because the **transverse fascicles** do not extend to the distal border of the palm, while the **superficial transverse metacarpal ligaments** along the **interdigital folds** do not extend much past these folds in the proximal direction.

The **palmar aponeurosis** blends laterally with the **superficial fascia** of the **thenar** and **hypothenar muscles**, which continues dorsally from this junction to the metacarpus and thus borders the **central compartment** of the palm on both sides.

Superficial to the fascia of the hypothenar muscles, the **palmaris brevis muscle** arises from the medial border of the aponeurosis and passes to the skin on the ulnar border of the hand, where it forms a slight depression when in the contracted state.



The **longitudinal slip** of the **palmar aponeurosis** has been incised over the flexor tendons of the ring finger, exposing the **deep expansions** of the aponeurosis that pass to the ligaments of the **metacarpophalangeal joints**.

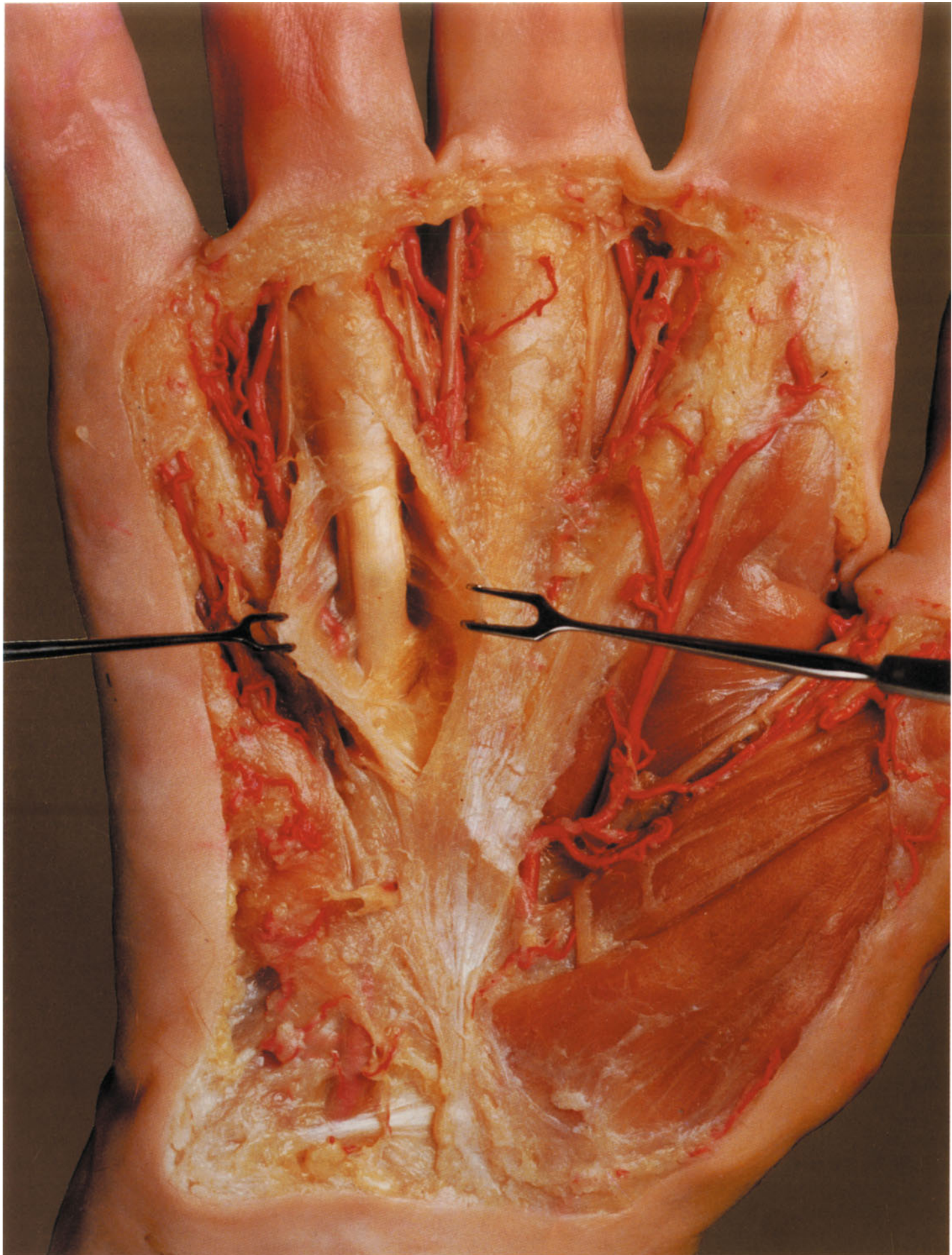
The **ligaments** about the **metacarpophalangeal joints** consist of fibrocartilaginous plates that arise from the bases of the **proximal phalanges** and cover the palmar surfaces of the metacarpophalangeal joints as the **palmar ligaments**. The palmar surfaces of the ligaments are grooved to accommodate the flexor tendons. Connected to the sides of the grooves are the **digital tendon sheath** with its rather thin **digital fibrous sheath** and the **deep transverse metacarpal ligaments**, which interconnect the palmar ligaments of the second through fifth metacarpophalangeal joints.

The **deep expansions** from the **palmar aponeurosis** pass mainly toward the angle formed by these structures and join with the superficial longitudinal slips to extend the **digital fibrous sheath** of the hand a short distance proximally.

This arrangement creates a **fibrous canal** whose entrance is a very oblique opening located at the free border of the deep expansions of the aponeurosis. This opening has a relatively proximal location in this specimen, as the deep expansions may attach to the metacarpal bone before proceeding to the metacarpophalangeal ligaments.

The deeper expansions of the **superficial longitudinal slips** are also attached to the exposed initial portion of the **digital fibrous sheath** over the metacarpophalangeal joints of the fingers.

The shrinkage of the superficial and especially the deep expansions of the palmar aponeurosis associated with a **DUPUYTREN contracture** accounts for the limitation of finger extension at the metacarpophalangeal joints.



The palmar neurovascular supply of the fingers has been exposed in the intervals between the longitudinal slips of the preserved **palmar aponeurosis** by removing the monticular fatty tissue and dissecting the vessels and nerves distally to the **superficial transverse metacarpal ligaments** in the interdigital folds.

The vessels and nerves pass between the **metacarpophalangeal joints** and are arranged such that each **common palmar digital artery** divides into two **proper palmar digital arteries** that are usually crossed on the volar side by one **proper palmar digital nerve**.

All the proper palmar digital nerves except those supplying the little finger and index finger arise from **common digital nerves**, which are crossed superficially by the **superficial palmar arch** and often by the common palmar digital arteries. As a result, the relation of the arteries to the nerves generally becomes reversed as they pass through the palm.

The superficial **fascia** of the **thenar** and **hypothenar muscles**, which blends with the sides of the palmar aponeurosis, has also been removed along with the fascia over the **ulnar artery** and **ulnar nerve**. This fascia, a continuation of the superficial antebrachial fascia, is also termed the **volar carpal ligament** because of its distinctive thickness. It arises from the deep layer of the stratum subcutaneum and has formed a relatively capacious flat tunnel that may be called the **ulnar carpal canal**. The **ulnar nerve** has been tagged within the canal lateral to the **pisiform bone**. The **ulnar nerve** and **artery** both disappear distally beneath the **palmaris brevis muscle**.

On the thenar eminence, the **abductor pollicis brevis muscle** has been separated into its superficial and deep layers, which are consistently present. A **branch** of the **median nerve** enters the expanded interval between the muscle layers. It passes to the surface between the **superficial head** of the **flexor pollicis brevis muscle** and the **abductor pollicis muscle** as one of many possible variations in the nerve supply to the thenar eminence.



The **palmar aponeurosis** has been removed, exposing a typical **neurovascular pattern** in the palm. A well-developed **superficial palmar arch** arises from the **ulnar artery** and is completed by a deeply situated **superficial palmar branch** of the radial artery. That branch connects in turn with the **radialis indicis artery**, which branches from the **princeps pollicis artery**, the principal artery of the thumb.

The **common palmar digital arteries** radiate from the **superficial palmar arch** between the flexor tendons of the fingers toward the interdigital folds, dividing into the **proper palmar digital arteries** proximal to the folds. Nearby, two somewhat deeper **common digital nerves** arise from the **median nerve** and one **common digital nerve** from the **ulnar nerve**, the common nerves dividing into the **proper palmar digital nerves** earlier than the arteries. One **proper palmar digital nerve** is supplied directly to the ulnar side of the little finger from the ulnar nerve, and one passes to the radial side of the index finger from the radial nerve.

The **median nerve** divides into its terminal branches immediately distal to the **flexor retinaculum**, while the **ulnar nerve** does so near the **pisiform bone**, where its **superficial branch** has been tagged.

The territories of the two nerves almost always meet on the midline of the ring finger, although, as STOPFORD showed clinically, there are rare exceptions in which this pattern may be shifted by an entire fingerwidth.

The **flexor tendons** of the fingers, partly enclosed in synovial sheaths, emerge from the **carpal tunnel** at the distal margin of the **flexor retinaculum**. Visible between the tendons are the **lumbrical muscles**, which pass to the radial sides of the four fingers.

A black bristle has been placed beneath the **proper palmar digital nerves**, which usually cross in front of the **proper palmar digital arteries** or, as between the index and middle fingers, divide and loop around them.



The **subcutaneous tissue** of the finger consists of fat heavily permeated by tough connective tissue, creating a relatively firm structure that fills the space between the skin and the passive motor apparatus of the hand. This relatively homogeneous mass of fibrofatty tissue is traversed by the **proper palmar digital arteries and nerves**.

The **cutaneous ligaments** of the fingers (GRAYSON's ligaments) are not defined in this specimen. Generally they are not demarcated from the other connective tissue structures clearly enough to be appreciated as separate structures.

The **palmar arteries and nerves** that supply the fingers lie alongside the **digital tendon sheath**, which has been exposed in this specimen. The **proper palmar digital nerves** have been tagged at the level of the **metacarpophalangeal joints**. Distal to that level, each of the nerves gives off a **dorsal branch** that supplies the dorsum of the finger from the middle phalanx to the nail bed.

The **nerves** supplying the fingers are superficial to the **arteries**, so they usually cross volar to the origins of the **proper palmar digital arteries**. There are two sites where the **proper palmar digital nerves** divide and pass around the **common palmar digital arteries**.

The numerous branches of the **proper palmar digital nerves** end in tiny **lamellated corpuscles** [VATER-PACINI bodies]. The proximal bristle marks the **muscular branches** of the **common digital nerves** from the **median nerve** that supply the two **lumbrical muscles** on the radial side.

The **proper palmar digital arteries** anastomose by an arterial arch at the tuberosity of the distal phalanx shortly after giving off a branch to the nail bed, which is also accompanied by a nerve branch.

The **digital fibrous sheath** of the middle finger has been exposed between the vessels and nerves. The thick **annular part** of the sheath over the proximal phalanx gives way abruptly to a thin **cruciform part** over the proximal interphalangeal joint, through which the longitudinally grooved tendon of the **flexor digitorum profundus muscle** can be seen. Cruciform structures cannot be seen over the tendon because of their normal high transparency. This part of the sheath is succeeded distally by an annular part over the middle phalanx.



The **digital flexor compartment** is the **central compartment** of the palm. It transmits the flexor tendons of the fingers, which enter it from the forearm by passing through the **carpal tunnel**. Consequently, the tendons in the carpal tunnel had to be divided and reflected out of the tunnel in order to expose the posterior wall of the compartment.

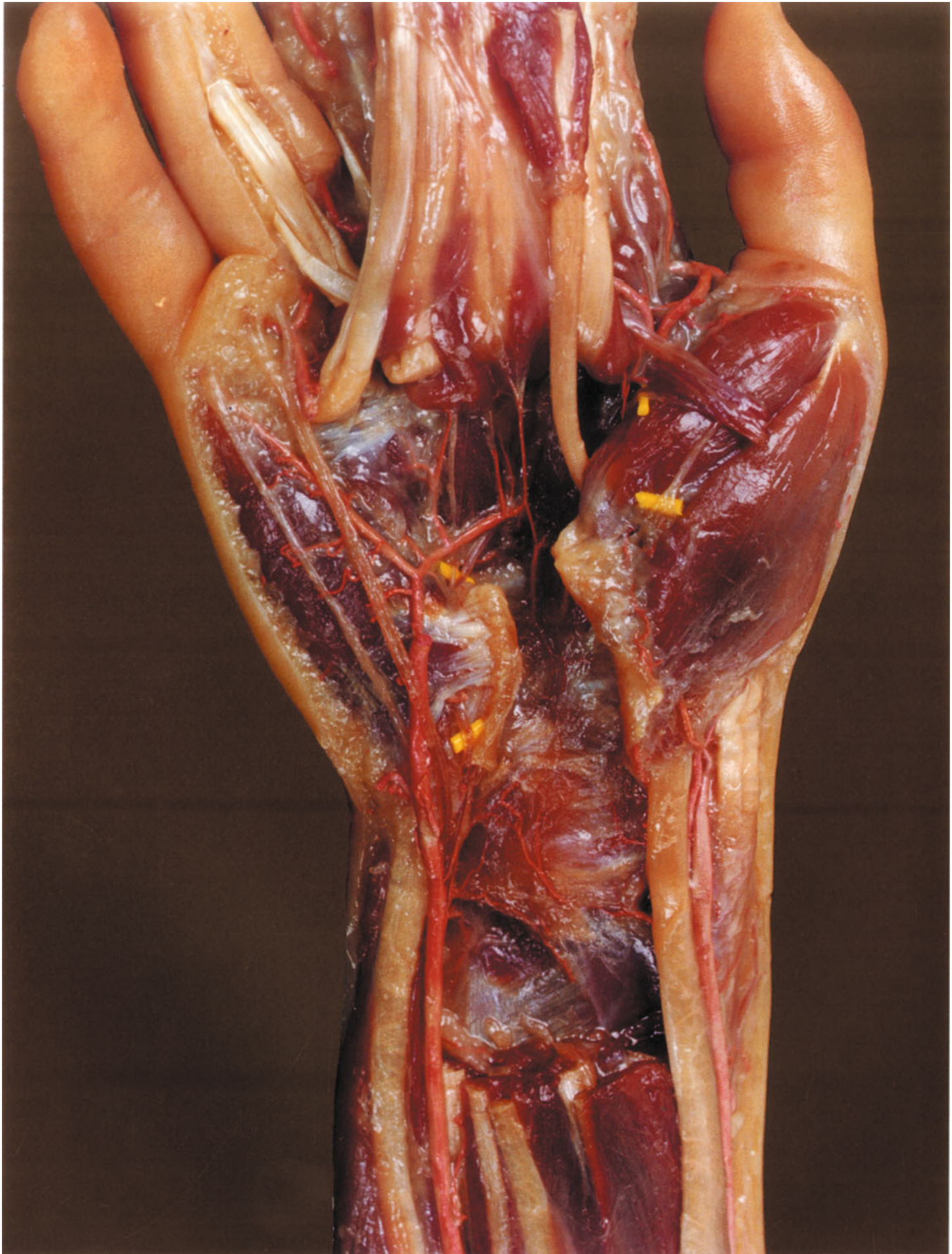
The **flexor retinaculum** has been resected between the two **carpal eminences**, exposing the underlying **capitate bone** and the **radial carpal ligament** radiating from its head. Just distal to the capitate bone is the **third metacarpal bone**, which bears the origin of the dark-colored **transverse head** of the **adductor pollicis muscle**. Medial to this origin, the **second palmar interosseous muscle** and **third dorsal interosseous muscle** are visible in the **interosseous space** between the **third and fourth metacarpal bones**.

Originally these muscles were covered by a connective tissue layer called the **deep palmar fascia**, which surrounded the deep palmar arch and the deep branch of the ulnar nerve.

The **deep branch** arises from the **ulnar nerve** at the level of the **pisiform bone**. Distal to the **hook** of the **hamate bone**, it passes deeply between the **abductor digiti minimi muscle** and **flexor digiti minimi brevis muscle** along the **pisohamate ligament**. Before disappearing beneath the adductor pollicis muscle, this deep branch supplies the **interosseous muscles** and the two ulnar **lumbrical muscles** with branches that include numerous sensory fibers for the metacarpophalangeal joints of the fingers.

This segment of the **deep branch** of the **ulnar nerve** is accompanied somewhat farther distally by the **deep palmar arch**, which is a continuation of the **deep palmar branch** of the **ulnar artery**. This branch does not pass deeply in company with the deep branch of the ulnar nerve but does so at a separate site medial to the hypothenar musculature. As is often the case, it gives off the **ulnar artery** for the **little finger** before giving off the **palmar metacarpal arteries**.

The **median nerve** has been transected with the digital flexor tendons, shortened somewhat, and reflected over the thenar musculature. Two tagged **muscular branches** for the thenar muscles arise from the stump.



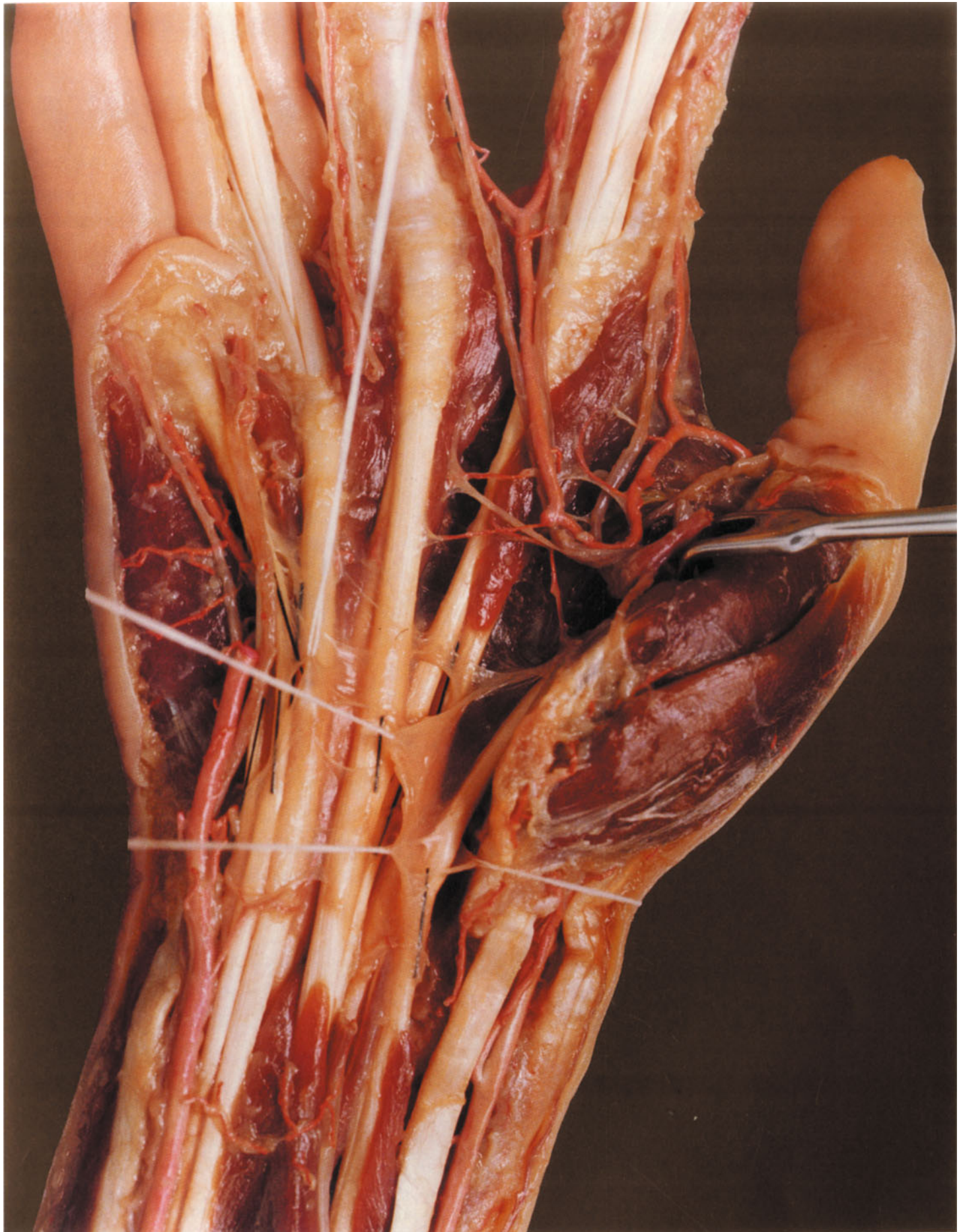
The fact that the development of the **carpal tendon sheaths** continues after birth does not account for all the morphologic variations that are found. The **tendon sheath** of the **flexor pollicis muscle** is usually described and depicted as a cylindrical tube that more or less closely envelops the tendon and extends proximally to the point where the tendon starts. This dissection presents a different picture, however, which is fully consistent with the precise accounts given by POIRIER, VON BARDELEBEN, and other authors.

The tendon sheath in the carpal region shows a substantial ulnar **outpouching** that extends dorsal to the long flexor tendons and reaches almost to the **flexor digitorum profundus** tendon of the little finger. This structure, then, rather than the **common flexor sheath**, separates the long flexor tendons that lie radial to it from the posterior wall of the **carpal tunnel**. Therefore it deserves the term that was formerly applied to it: the **radial carpal sac** (saccus carpalis radialis).

This **radial carpal sac** has been incised and the cut edges retracted following removal of the **flexor retinaculum**. A **mesotendineum** (mesotendon) stretches from the ulnar border of the **flexor pollicis longus** tendon to the ulnar wall of the sac, which is applied to the **flexor digitorum profundus** and **superficialis** tendons for the index finger. Behind the mesotendineum, a **pouch** extends almost to the **flexor digitorum profundus** tendon for the ring finger and thus closely approaches the dorsal pouch of the **common flexor sheath**.

A probe has been inserted proximally along the **flexor pollicis longus** tendon to the start of the sac, which is located about one fingerwidth proximal to the margin of the **flexor retinaculum**. The radial carpal sac is continuous distally with the digital tendon sheath of the thumb.

The long flexor tendon sheaths that have been opened and marked with probes are described in the next figure.



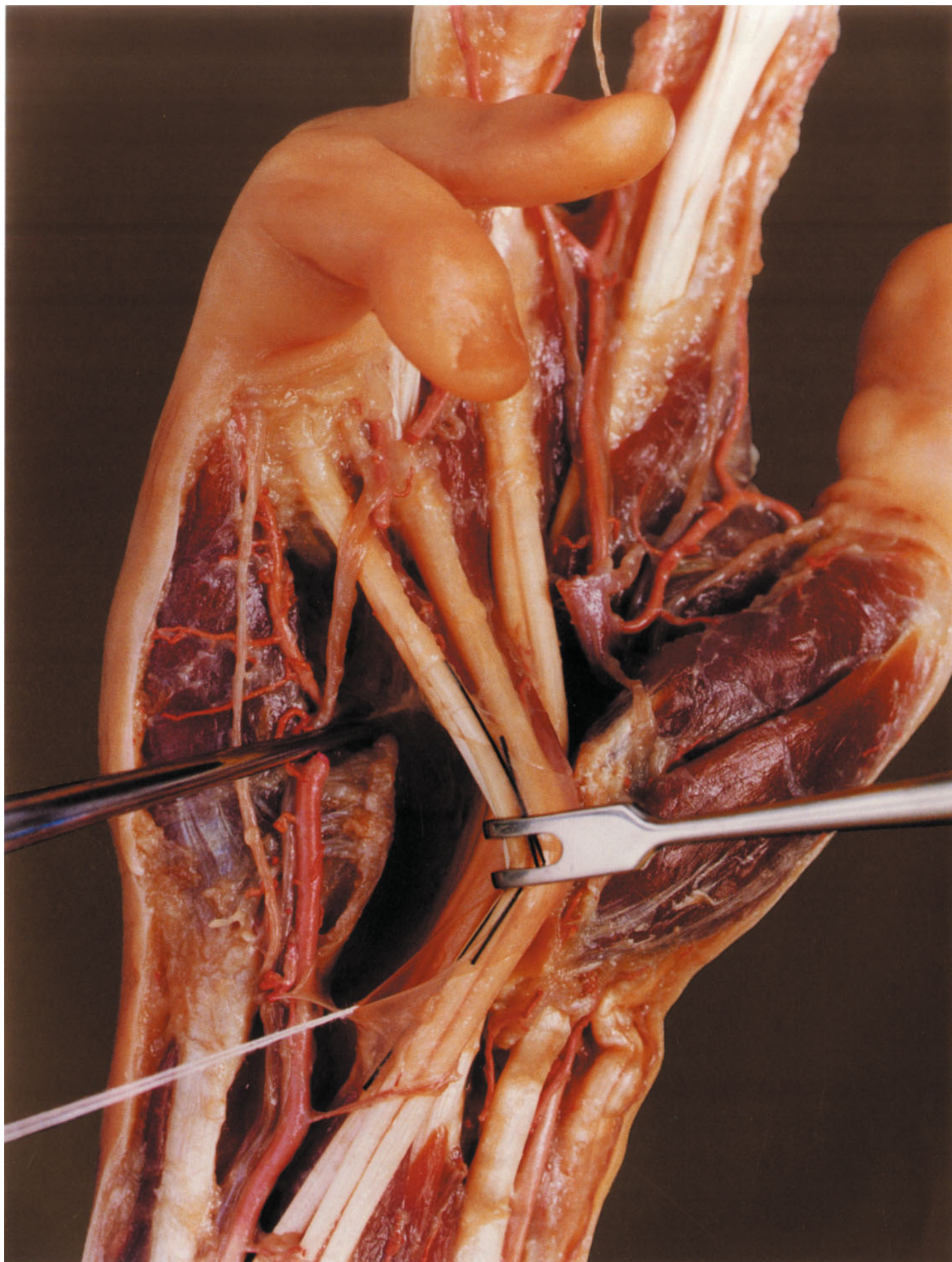
The **common flexor sheath** is usually portrayed as a large, common, sac-like sheath that envelops the long flexor digitorum tendons more or less in isolation. In reality, a common, relatively flexible mass of connective tissue binds the tendons together, creating a **block** within the **carpal tunnel** that, on the ulnar side, is enclosed only to a modest degree by a common tendon sheath that has short pretendinous and retrotendinous extensions. Both extensions just reach the tendons of the ring finger. An extension separating the superficial and deep groups of tendons is present only in some cases.

The **common flexor sheath**, or **ulnar carpal sac**, has been longitudinally incised and opened from the center of the two-prong retractor to the point where a traction tape has been placed in the sheath. A probe has been inserted along the two tendons of the little finger, reaching to the proximal border of the tendon sheath. A parallel probe has been placed on the ulnar side of the superficial tendon for the ring finger, indicating the proximal end of the sheath. The long probe above the two-prong retractor has been inserted into the opened connection of the **ulnar carpal sac** with the digital tendon sheath of the little finger. The shorter, crossing probe lies in front of the upper end of the short **mesotendineum** of the superficial tendon to the little finger.

Elevating the tendon block out of the **carpal tunnel** has exposed the posterior surface of the **ulnar carpal sac**, through which the tendons of the **flexor digitorum profundus muscle** can be seen. It extends to a **common mesotendineum** that stretches between the two carpal sacs from the posterior wall of the carpal tunnel to the connective tissue block in which the tendons are embedded.

Within the **connective tissue block**, the **tendons** for the **index** and **ring fingers** are each surrounded by their own sheath, into which probes have been inserted. The tendon sheath of the middle finger appears incomplete because it is still heavily permeated by connective tissue trabeculae.

Both of these tendon sheaths develop postnatally and, with aging, may develop connections with the carpal sacs. A connection between the carpal sacs is occasionally found in adults or may form pathologically following the development of a V-shaped area of palmar cellulitis deep to the tendon packet.



The **digital tendon sheaths** consist of a **fibrous sheath** and a **synovial sheath**. They extend from the **head** of the **metacarpal** to the **base** of the **distal phalanx**.

The **digital tendon sheath** of the **index finger** has been opened, and two probes have been inserted into the terminal portions of its cavity to show its precise extent.

Opening the tendon sheath has exposed the **flexor digitorum profundus tendon**, which is markedly flattened and expanded in front of the **proximal interphalangeal joint** of the finger and bears a central longitudinal groove. Proximal to this expansion, the profundus tendon is flanked by two **slips** of the **flexor digitorum superficialis muscle** in an area called the **tendinous chiasm**.

The proximal part of the **tendinous chiasm** is enveloped by the **annular part** of the **fibrous sheath** of the proximal phalanx and provides effective guidance for the motion of both tendons.

The very strong transverse fibers of the **annular part** of the fibrous sheath may cause a delay in finger flexion if a localized thickening of the tendons hampers tendon gliding. When voluntary flexion is attempted, the “lagging finger” is briefly immobile and then springs abruptly into the flexed position.

Between the annular parts of the proximal and middle phalanges is the thin **cruciform part** of the **fibrous sheath**, which lies opposite the proximal interphalangeal joint of the finger. Because of its natural transparency, its constituent decussating fiber bundles are difficult to see, while the flattened and grooved **flexor digitorum profundus tendon** is clearly visible through the substance of the sheath. The **cruciform part** of the sheath is somewhat thicker in front of the metacarpophalangeal joint, where it encloses the initial part of the digital tendon sheath, so little of the underlying flexor digitorum superficialis tendon can be seen.

The insertion of the **flexor digitorum profundus tendon** at the **base** of the **distal phalanx** defines the **distal end** of the **tendon sheath**, which lies approximately on the plane of the distal interphalangeal joint space. But the boundary of the **distal phalanx** is marked by a volar skin crease that lies anterior to the proximal edge of the trochlear head of the **middle phalanx**. In surgical procedures, therefore, only the distal two-thirds of the distal phalanx can be safely incised without fear of cutting into the tendon sheath.



The dissection of the index finger was described in the previous figure. The **proper palmar digital nerves** supplying the **middle finger** have been displaced slightly toward the midline of the finger, placing them in front of the tendon sheath. Normally they run alongside the tendon sheaths in company with the **proper palmar digital arteries**, where the bow of the contracting tendons protects them from pressure injury when the hand grips an object with great force.

The tendon sheath of the **ring finger** has been opened and the **flexor digitorum profundus tendon** retracted with a hook to display the **vincula tendinum**. Between the two slips of the **flexor digitorum superficialis tendon**, a **vinculum longum** passes from the proximal phalanx to the tendon of the **flexor digitorum profundus**. Sometimes this structure is reduced to a very narrow synovial band. Anterior to the insertion of the profundus tendon is a **vinculum breve**, which is particularly broad in this specimen. Its origin extends from the middle phalanx and palmar ligament of the distal interphalangeal joint to the distal phalanx.

The **vinculum breve** for the insertion of the **flexor digitorum superficialis muscle** is much more modest. It is divided, like the tendon, and arises mainly from the **palmar ligament** of the proximal interphalangeal joint. The **vincula longa** of the **flexor digitorum superficialis muscle**, also divided, are usually very narrow bands that are attached to the tendon slips.

This dissection also shows an unusual **mode of insertion** of the **flexor digitorum superficialis muscle**. Its two tendon slips temporarily unite proximal to the **proximal interphalangeal joint** through an exchange of crossing fibers, with the result that the band-like tendon slips flanking the profundus tendon are transformed into two **rounded cords**. The insertion of these rounded cords extends from the **base** of the **middle phalanx** far distally over its palmar surface, showing an almost undiminished thickness. The **vinculum breve** of the **profundus tendon** is attached between the cords.



The tendon sheath of the **ring finger** has been opened from the palmar side, and the tendons have been elevated from it to display the posterior wall of the sheath.

The **digital synovial sheath**, which is attached to the palmar side of the phalanges between the joints, has been elevated with small air bubbles at a circumscribed site in the distal portion of the proximal phalanx. The **palmar ligaments** are fibrocartilaginous plates on the palmar surfaces of the phalangeal joints that create a smooth surface contour over the joints.

The largest **palmar ligament** belongs to the metacarpophalangeal joint, which appears foreshortened due to the sagging position of the finger. Attached to the sides of the ligament are the joint capsule, the proximal end of the **cruciform part** of the **fibrous sheath**, and the **deep transverse metacarpal ligaments**, which interconnect the palmar ligaments.

The relatively light area at the center of the opened tendon sheath is caused by the **vaginal ligament** of the **proximal interphalangeal joint**. It lies proximal to the visible **middle flexion crease** of the finger, since this crease overlies the **base** of the **middle phalanx**. The rounded slips of the **flexor digitorum superficialis** tendon, which arise from the narrow slips of that tendon after they exchange fibers behind the profundus tendon, insert onto the palmar surface of the middle phalanx, their site of insertion extending distally well past the base of the phalanx.

The **flexor profundus tendon** for the ring finger, after crossing the divided tendon of the **flexor digitorum superficialis** at the **tendinous chiasm**, does not become as expanded as it does in the middle finger. The **annular part** of the **fibrous sheath** of the middle finger is particularly distinct in this specimen, so the relation of the proximal **cruciform part** of the fibrous sheath to the **palmar ligament** can be clearly seen.

As a **variant**, this specimen displays a divided **third lumbrical muscle** with an accessory belly that passes, atypically, to the ulnar side of the extensor aponeurosis of the middle finger.



The **extensor retinaculum** [dorsal carpal ligament] arises from the superficial **antebrachial fascia** at the distal end of the forearm. It is attached by several septum-like connective tissue slips to the dorsal surface of the distal end of the radius and to the carpal ligaments, forming compartments that contain the extensor tendons of the hand and their sheaths.

There are six dorsal **tendon sheath compartments** in the hand. The tendon sheaths all start near the proximal margin of the **extensor retinaculum** but vary in their distal extent. The most prolonged sheaths are for the tendons of the **extensor digiti minimi muscle** and **abductor pollicis longus muscle**, located on the ulnar and radial borders of the hand. The sheaths do not necessarily enclose the tendons circumferentially all the way to their end; they frequently have tongue-like extensions, as described in Fig. 207 of Vol. I. Also, there are several places where the tendon sheaths are poorly demarcated from other clefts and spaces that occur along the course of the tendons.

The common sheath of the two **extensores carpi** tendons divides as it approaches the insertion of the tendons. The radial division is overlapped by the **extensor pollicis longus** tendon sheath, and the two sheaths usually communicate at that site. The tendons of the **extensor indicis** and **extensor digitorum** occupy a common sheath from the outset.

The **extensor digitorum** tendons often divide into multiple tendons. It is very common for the ring finger to have a separate tendon that also passes to the little finger. Only one scant **intertendinous connection** is present in this specimen.

The tendons on the dorsum of the hand were covered by the [**superficial**] **dorsal fascia** of the hand, a prolongation of the **flexor retinaculum** that blends distally with the dorsal aponeuroses of the fingers. The **skin** overlying the dorsal fascia is very mobile and easily raised because the thin fatty layer of the **subcutaneous tissue** with its deep layer of stratum subcutaneum is only loosely attached to the fascia. The dorsal surfaces of the **dorsal interosseous muscles** are covered by a thin fascia also called the **deep dorsal fascia** of the hand.



The **antebrachial fascia** is an extension of the **superficial fascia** that covers the posterior surface of the forearm, where it forms a very homogeneous and transparent layer. The **deep layer of the stratum subcutaneum** in this region is not elaborated into **flat tunnels** as it is elsewhere, because – aside from a few vessels that connect the superficial venous network with deeper veins – there are almost no nerves or vessels that pass to the surface in the posterior antebrachial region.

The **subcutaneous tissue** including the **deep layer of the stratum subcutaneum** has been retracted to expose the subcutaneous structures on the plane of the subcutaneous tissue, where only the course of the **cephalic vein** can be seen. The **cephalic vein** develops from the major portion of the **dorsal venous network** of the **hand**. In this case it has followed the more posterior route along the **lateral border** of the **forearm** to enter the **lateral bicipital sulcus**.

In cases where the cephalic vein takes a more anterior course, passing forward around the lateral border of the forearm, it usually leaves the more posterior route as an accessory pathway for a vessel called the **accessory cephalic vein**.

The **muscles** are clearly visible through the fascial layer, because the **aponeurotic septa** that develop between the muscles are connected to the fascia. Owing to this arrangement, the **extensor carpi radialis brevis muscle** is clearly demarcated from the **extensor digitorum muscle**, even though both muscles arise from the lateral epicondyle of the humerus. In the same way, the muscle bellies of **extensor carpi ulnaris** and **extensor digiti minimi** are clearly differentiated from each other and from the **extensor digitorum**.

The **tendons** of the **extensor digitorum** are also clearly visible, bordering medially on the muscles that pass superficially from deeper levels.

The attachment of the deep layer of the stratum subcutaneum to the superficial fascia is indicated by the connective tissue attachments that have been pulled taut by the retraction of the skin.



The **antebrachial fascia** has been divided and opened, and the posterior surfaces of the **extensor digitorum muscle** and **extensor digiti minimi muscle** have been dissected free where not covered by a common fascia supplementing their skeletal origins.

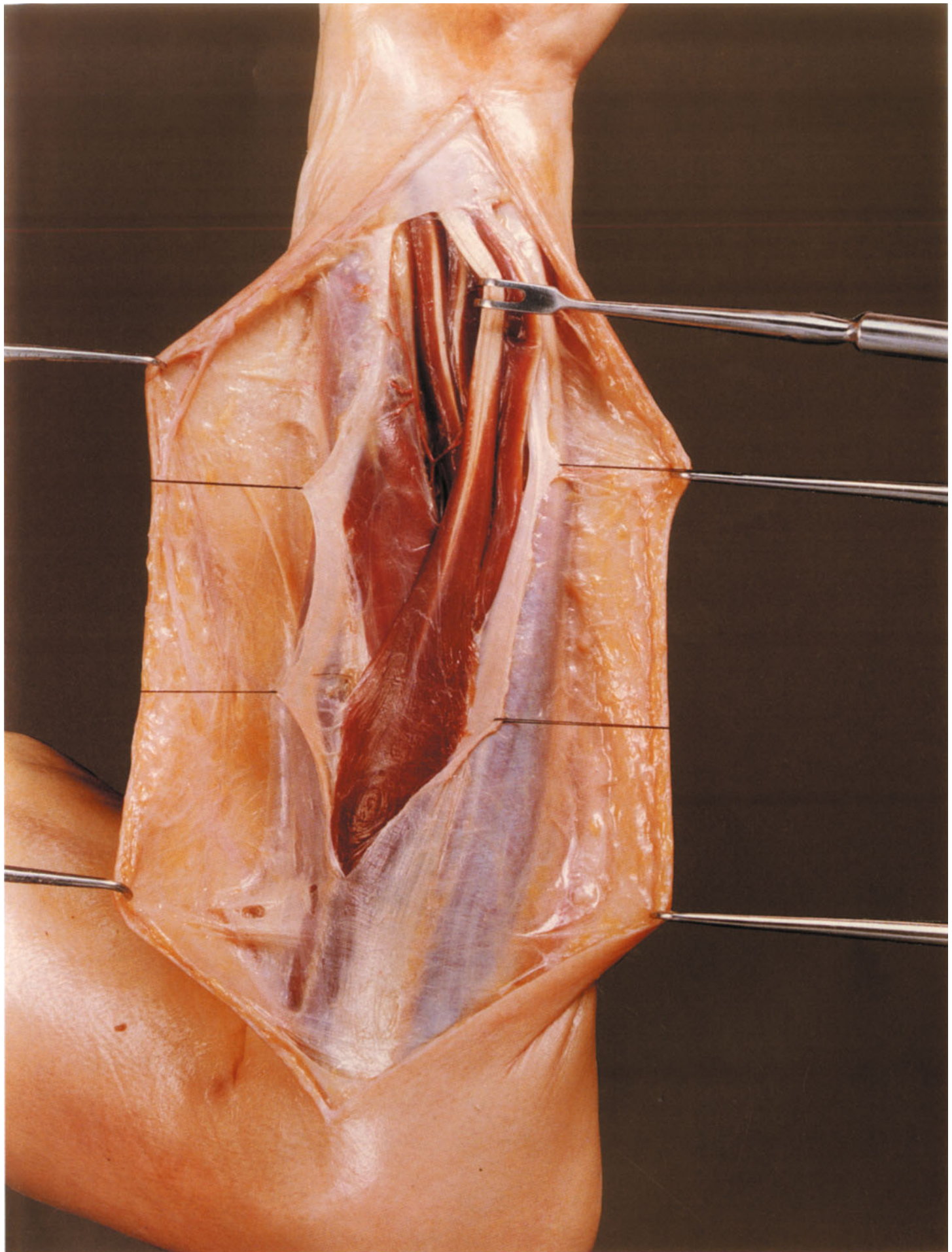
Between the **extensor digitorum muscle** and **extensor carpi radialis brevis muscle** is an **intermuscular aponeurotic septum** by which the two muscles are interconnected in the proximal third of the forearm. Similarly, the **extensor digiti minimi muscle** first separates from the **extensor digitorum muscle** distal to this area of attachment. Both muscles arise by a common belly from the **lateral epicondyle** of the humerus, where there is an elongated tendinous expansion that supplements the skeletal origins of the muscles.

Ulnar retraction of the **extensor digitorum muscle** has exposed the muscles of the deep layer that had not already become superficial at the radial border of the **extensor digitorum muscle** (i.e., the **abductor pollicis longus** and **extensor pollicis brevis**).

The normally obscured part of the deep extensor group does not have a common deep fascia, which would be interposed between the superficial and deep muscle groups. But the individual muscles are invested by their own delicate **muscle fascia**, which is too thin to be easily perceived.

The loose connective tissue between the muscles contains very little fat. Removing that tissue has exposed, from the ulnar to the radial side, the **extensor indicis**, **extensor pollicis longus**, **extensor pollicis brevis**, and **abductor pollicis longus muscles**. A narrow strip of radius is visible between the two central muscles.

At the site where the **antebrachial fascia** starts to cover the two radial muscles, it gains a relatively firm linear attachment to the **abductor pollicis longus muscle**.



Part of the **intermuscular aponeurotic septum** between the **extensor digitorum muscle** and **extensor carpi radialis brevis muscle** has been divided so that the **extensor digitorum** could be retracted far enough medially to display the distal border of the **supinator muscle**.

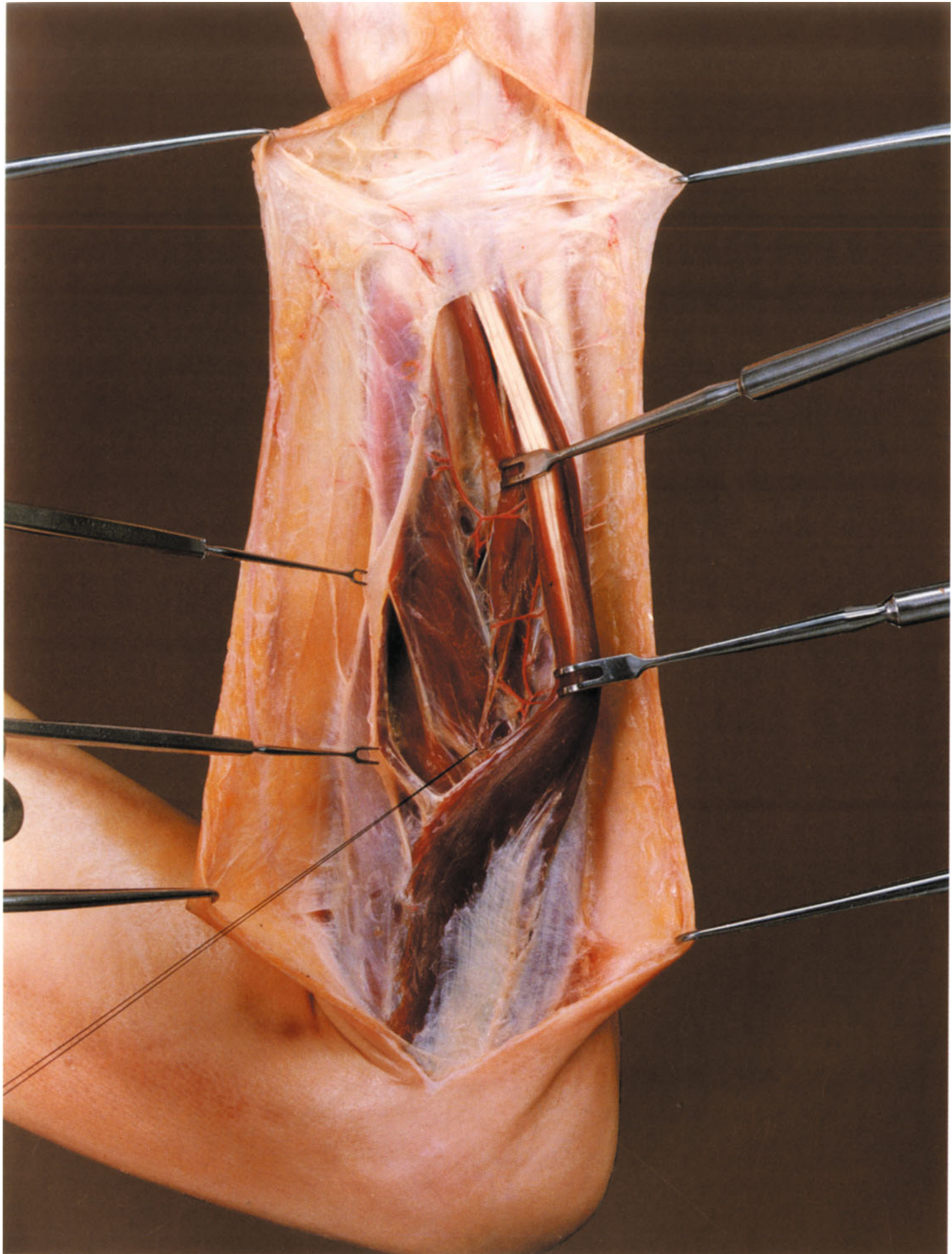
The **supinator muscle** borders directly on the **abductor pollicis longus**, a very long muscle that arises from the posterior surfaces of both forearm bones and from the interosseous membrane.

The boundary between these two muscles may show a small discontinuity if the radial attachments of the superficial and deep parts of the **supinator muscle** do not quite coincide.

The **deep branch** of the **radial nerve** runs between the two planes of the **supinator muscle**, emerging close to the distal border of the muscle and not at the border itself, as it might appear. Thus, the traction thread is elevating the nerve almost but not completely to its site of emergence from the muscle.

The **deep branch** of the **radial nerve** gives off several muscular branches to the extensors of the forearm and continues distally on the dorsal aspect of the **interosseous membrane** to the wrist as the **posterior interosseous nerve**. The two ulnar muscles of the deep group have been retracted to show the position of the nerve and its terminal muscular branches. Nearby is a perforating branch of the **anterior interosseous artery**, which is among the proximal perforating branches of the artery. It is different from the large branch of the anterior interosseous artery that pierces the interosseous membrane at a much more distal level and contributes to the dorsal carpal rete.

Structures visible on the deep surface of the retracted skin are the **cephalic vein** and the **posterior antebrachial cutaneous nerve**, which branches from the **radial nerve**, enters the posterior surface of the forearm anterior to the **lateral epicondyle**, and runs distally near the **lateral border** of the forearm.



The superficial extensors on the ulnar side of the forearm also have an **intermuscular aponeurotic septum**, which is placed between the **extensor carpi ulnaris muscle** and **extensor digiti minimi muscle**. It extends upward to the **medial epicondyle** and is blended deeply with the aponeurotic origin of the **supinator muscle**.

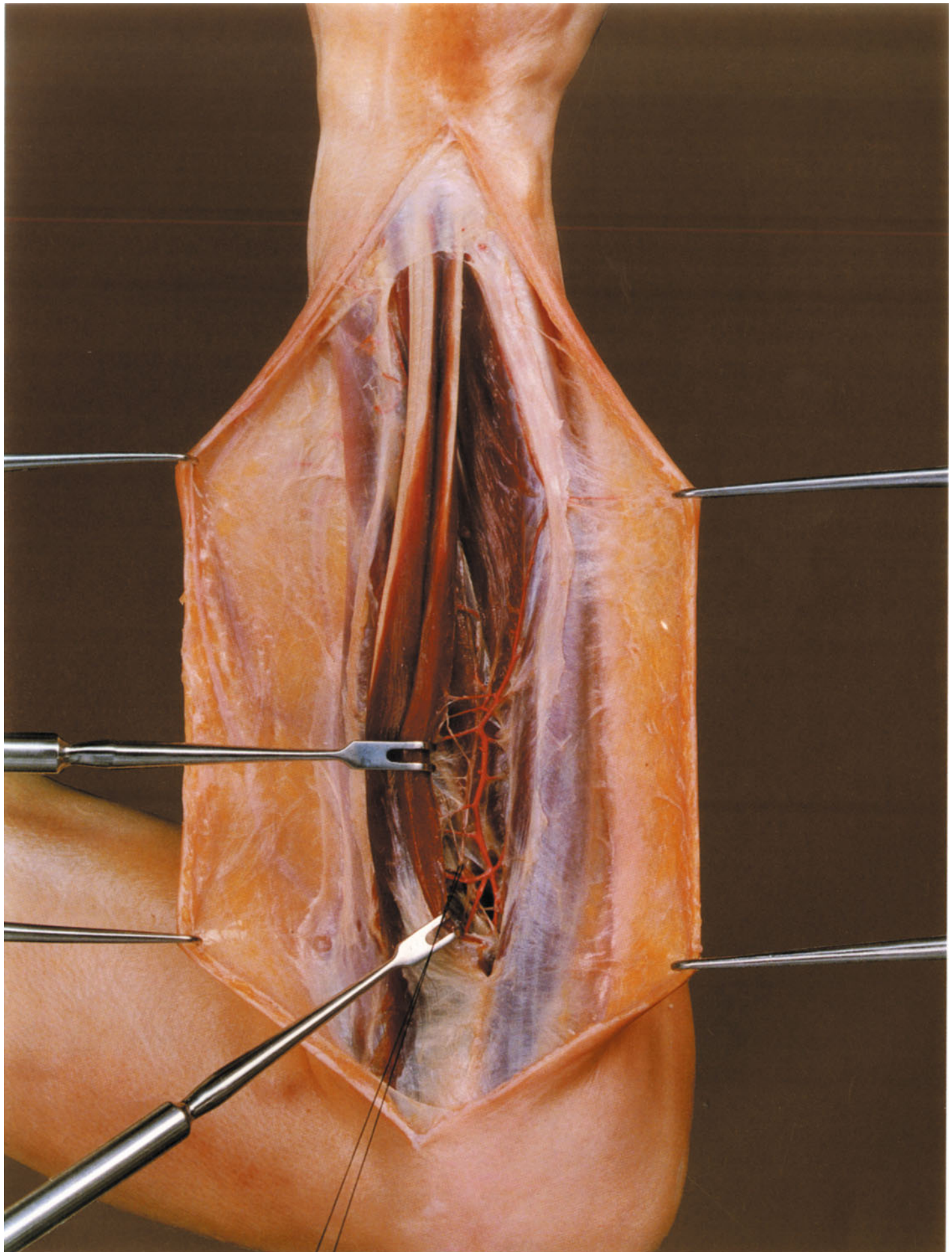
The septum has been partially divided, allowing the **extensor digitorum muscle** and **extensor digiti minimi muscle** to be retracted laterally to expose the **supinator muscle** near its distal border.

The **deep branch** of the **radial nerve** courses on a plane that divides the **supinator muscle** into a superficial and a deep layer. Part of the distinct **fascia** that covers the supinator has been removed posteriorly over the distally projecting deep layer of the muscle. Proximal to that site the **deep branch** of the **radial nerve** emerges from the **supinator muscle**, and farther distally the **posterior interosseous artery** enters the plane between the superficial and deep extensor groups.

Sometimes, as in this case, the **extensor pollicis longus muscle** reaches to the distal border of the **supinator muscle** on the ulnar side. It borders on the **extensor carpi ulnaris muscle** in the forearm.

The **extensor carpi ulnaris muscle** is ensheathed by the **antebrachial fascia**, which is attached to the **posterior border** of the **ulna**. Its area of origin on the dorsal surface of the ulna is bordered distally by the origins of the **extensor pollicis longus muscle** and **extensor indicis muscle**, which are visible.

The **posterior interosseous artery** gives off the **recurrent interosseous artery** below the **supinator muscle**, and it divides into branches in both layers of the extensor muscles. A long **anastomotic branch** extends to the perforating branch of the anterior interosseous artery or to the dorsal carpal rete.



The tendons of the **extensor digitorum muscle** often divide on the dorsum of the hand into multiple tendons that reconverge on reaching the **dorsal aponeurosis** of the fingers. The division of the tendons may be so extensive that they resemble an aponeurosis over the proximal metacarpal region. Adjacent tendons may be tied together by single or multiple **intertendinous connections**, as shown in Fig. 205.

The **extensor digitorum tendon** for the **index finger** is accompanied on the ulnar side by the **extensor indicis tendon** from the deep extensor group. As is usually the case, the tendon of the **extensor digiti minimi** splits into two tendons of insertion on the dorsum of the hand.

The **extensor tendon sheaths** pass through the six **tendon sheath compartments** of the **extensor retinaculum**. The tendon sheath of the **extensor pollicis longus muscle** in adults usually communicates with the underlying common tendon sheath of the two **extensores carpi radiales muscles**.

The dorsal tendons and tendon sheaths are covered by the transparent **dorsal fascia** of the **hand** (superficial dorsal fascia), which is a distal continuation of the **extensor retinaculum**. This fascia is so transparent that the underlying tendons and tendon sheaths in this specimen appear to have been dissected free. The **dorsal fascia** itself is clearly visible only over the **first dorsal interosseous muscle**, because in that area it is connected to the **deep dorsal fascia**, which covers the interosseous muscles.

The **superficial branch** of the **radial nerve** has been isolated superficial to the dorsal fasciae. This branch reached the dorsal side of the extremity by passing deep to the **brachioradialis tendon**. In this case it has appropriated some of the territory of the ulnar nerve, supplying the entire dorsum of the hand and the proximal, dorsal sides of all the fingers, as in the case described by LEARMOUTH. The **dorsal branch** of the **ulnar nerve**, which ordinarily supplies the dorsum as far as the middle finger, mainly passes to the little finger as the ulnar **proper palmar digital nerve** while sending a few small branches to the ulnar border of the hand.

There are cases in which the **dorsal branch** of the **ulnar nerve** supplies all of the dorsum by itself, and it is very common to find less extreme territorial shifts between the radial and ulnar nerve branches.



The **dorsal digital expansion**, the extensor aponeurosis of the fingers, is an elongated, triangular sheet of connective tissue on the dorsum of the fingers that contains thickened fiber tracts. It extends from the metacarpophalangeal joint to the distal interphalangeal joint of each finger and lies immediately deep to the **subcutaneous tissue**, which is almost devoid of fat in this region. The **tendons** of the **long extensor muscles** fuse at their narrow base and divide distally into one intermediate slip and two collateral slips.

The two **collateral slips** diverge toward the proximal interphalangeal joint, where they are separated by the full width of the joint. Then they converge and reunite at the **distal interphalangeal joint**, inserting by a common tendon into the **base** of the **distal phalanx**.

The **intermediate slip** is considerably thinner and extends only to the **base** of the **middle phalanx**, to which it is attached. The border of the dorsal digital expansion is thickened by a strong, well-defined **marginal slip** (“wing tendon”) that extends to the proximal interphalangeal joint and is joined by fibers from the **lumbrical** and **interosseous tendons**. Part of the marginal slip crosses the collateral slip to join with the intermediate slip in attaching to the **base** of the **middle phalanx**, while its more peripheral parts adjoin the collateral slip and pass with it to be attached to the **base** of the **distal phalanx**.

The **marginal slip** of the dorsal digital expansion lies dorsal to the axis of motion of the proximal and distal interphalangeal joints, so it extends the finger at these joints. It runs volar to the flexion-extension axis of the metacarpophalangeal joint, however, so it acts as a powerful flexor of that joint.

The **triangular area** between the marginal slip and collateral slip is occupied by a very thin, transparent sheet of connective tissue that is joined by several fibers from the marginal slip. Sometimes called the **triangular ligament**, its proximal part contains a thickened layer of transverse connective tissue fibers that are attached laterally to the joint capsule and to the **deep transverse metacarpal ligament**. They function as a retinaculum for the dorsal digital expansion, which forms a movable hood over the metacarpophalangeal joint.



The **shoulder joint** is a **spheroidal joint** in which the disparate sizes of the articulating surfaces give the joint an exceptionally broad range of movement while increasing its susceptibility to dislocation.

The figure shows an anterior view of a shoulder joint in a position of moderate **abduction**. Note that the **head** of the **humerus** has left the **glenoid cavity**, because the capacious joint capsule, being designed for maximum mobility, cannot retain the humeral head in the glenoid when the arm assumes this position.

The joint capsule has a physiologic **opening** at which the **synovial membrane** of the capsule communicates with the **subtendinous bursa** of the **subscapularis** muscle. This opening is situated between the **superior** and **middle glenohumeral ligaments**.

The **middle** and **inferior glenohumeral ligaments** are subtle thickenings of the anterior capsule wall that are identifiable only when viewed by transillumination. Sometimes the opening is located between the middle and inferior glenohumeral ligaments, and sometimes it is absent.

The **opening** in the **joint capsule** permits us to see the upper end of the **glenoid cavity** with its **glenoid labrum** and the segment of the **biceps tendon** that lies within the **joint cavity**. Above the **superior glenohumeral ligament** is the **coracohumeral ligament**, which arises from the root of the **coracoid process** and runs anterior to the biceps tendon. By covering the upper part of the **intertubercular sulcus**, it retains the biceps tendon in its groove, even with traumatic displacement of the humeral head. The part of the coracohumeral ligament that covers the sulcus is sometimes called the **transverse humeral ligament** and is considered part of the joint capsule.

The **roof** of the **shoulder joint** is formed by the **acromion**, the **coracoid process**, and the **coracoacromial ligament** connecting the coracoid process with the acromion. Because of this very strong structure, forcible abduction of the arm can pry the **humeral head** out of its shallow socket, tearing the inferior part of the capsule. If the injury has a rotational component, the humerus may sustain a **subcoracoid**, **axillary** or **infrapinous dislocation** in which the head remains within the torn joint capsule.



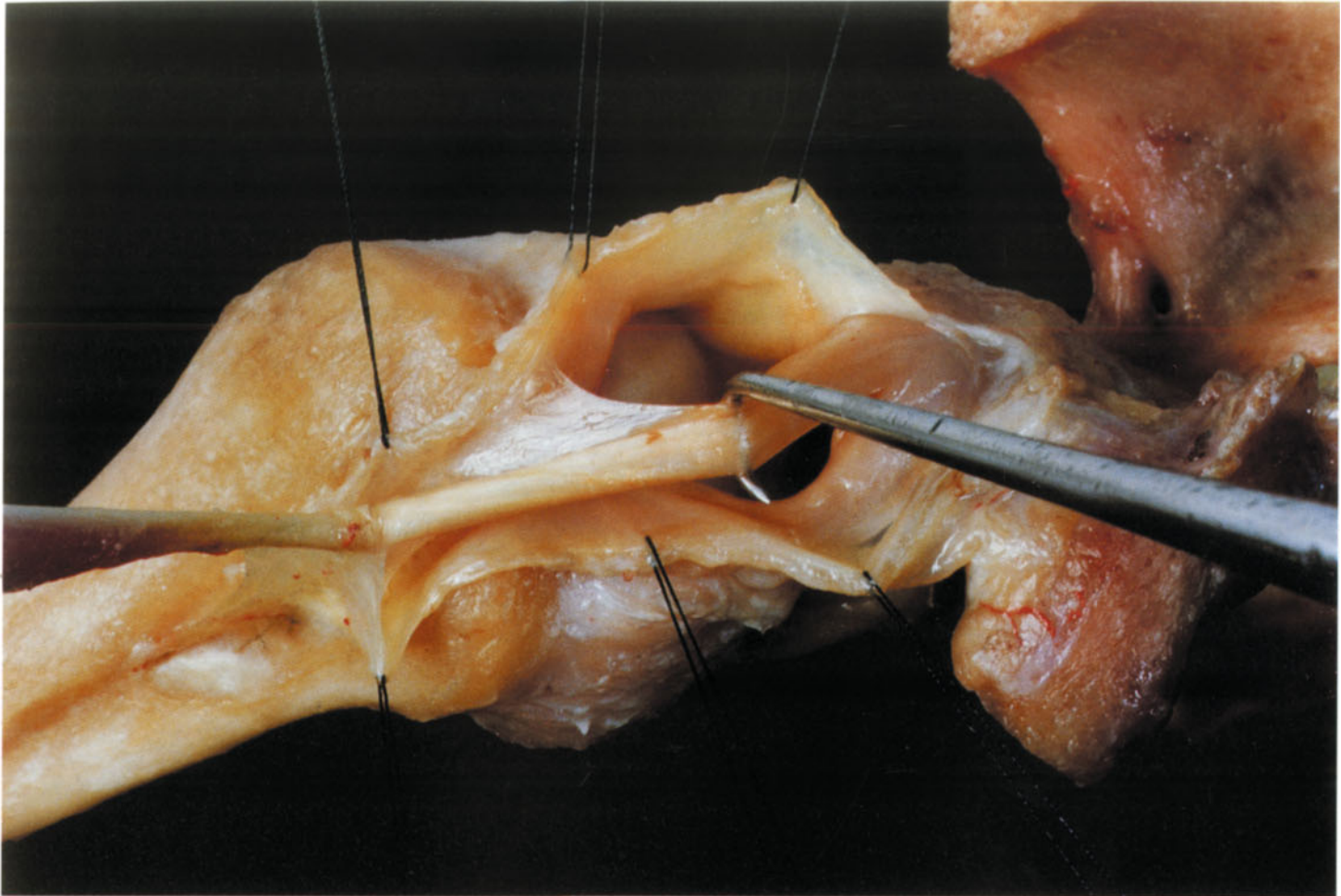
The **tendon of origin** of the **long head** of the **biceps brachii muscle** forms within the joint capsule during embryologic development. According to WELCKER, the tendon bulges into the joint cavity in the third month of fetal development, forming a **mesotendineum** that usually disappears with further maturation. But FICK notes that this structure may persist, and a mesotendineum is sometimes found in the **intertubercular tendon sheath** of adults. It may be considered an ontogenic remnant that has phylogenetic parallels. In the sheep, for example, the entire mesotendineum is preserved. The tendon remains outside the joint capsule in the horse and mole, and in certain other species it tends to regress as it does in man.

The biceps tendon in this specimen has a **mesotendineum**, which arises from the upper wall of the **intertubercular tendon sheath**, slightly behind its center, and passes distally toward its posterior wall. This mesotendineum has a pouch on its posterior aspect, into which a probe has been inserted in Panel B. The distal end of the intertubercular tendon sheath has been opened up with traction threads in Panel A, displaying the mesotendineum above the tendon.

In **Panel A**, the joint capsule has been incised and opened over the tendon of origin of the long head of the biceps brachii muscle. The incision passes through the center of the **coracohumeral ligament**, as indicated by the thickness of the cut surface. The proximal border of the superior flap of the capsule shows the relation of the **joint capsule** to the origin of the **tendon** of the long head of the biceps on the **supraglenoid tubercle**.

On the inferior flap of the **joint capsule**, the **coracohumeral ligament** and adjacent **superior glenohumeral ligament** can be seen proximal to the first thread on the right. A small interval separates the **superior glenohumeral ligament** from the **middle glenohumeral ligament**.

In **Panel B**, the posteroinferior portion of the joint capsule has been removed to display the interior of the **joint cavity**. The **glenoid cavity** is rimmed by the **glenoid labrum**, which gives attachment to the **joint capsule**. The intact anterior wall of the joint capsule is strengthened by the **middle** and **inferior glenohumeral ligaments**. The **humeral attachment** of the **joint capsule** has also been left intact.



A



B

Shoulder Joint 3

Deformation of the Joint Capsule with Arm Movements

Due to the large size of the **joint capsule**, which is necessary for the extensive range of shoulder movements, there are places in which the joint capsule tends to become lax or tightly stretched at the limits of shoulder excursions. Panels A and B show the shoulder joint in maximum adduction and abduction; Panels C and D show the joint in maximum internal and external rotation.

With **maximum adduction** as in **Panel A**, the superior part of the joint capsule is stretched over the head of the humerus, opening up the **subacromial space** with the **subacromial bursa**. The inferior part of the joint capsule is lax and bunched together, forming a dependent capsular pouch that creates an **axillary recess** in the joint space. Tension folds pass from the dependent part of the capsule to the tense upper part.

With **maximum abduction** as in **Panel B**, the inferior part of the joint capsule is stretched over the lower part of the humeral head, which is displaced from the glenoid cavity. The superior part of the capsule is lax and sags into the **subacromial space**, causing the capsule to project medially past the superior border of the glenoid cavity. It is likely that tension from the adjacent **supraspinatus muscle** accentuates this medial displacement of the capsule. Again, the lax part of the capsule is heaped into a prominent fold that extends toward the tense part of the capsule.

The marked displacements and constrictions of the subacromial space account for the **abduction pain** that occurs with inflammatory periarticular processes and with diseases of the **subacromial bursa**, which are particularly common in the elderly.

Panel C shows the response of the joint capsule to slight abduction and **maximum internal rotation**. The posterior part of the humeral head has left the glenoid cavity, and the posterior part of the capsule is stretched over it.

Panel D shows the capsular response to slight abduction and **maximum external rotation**. The posterior part of the capsule is bunched into a crumpled heap that overlaps much of the **glenoid labrum**, its medial displacement accentuated by the adjoining **infraspinatus muscle**.



A



B



C



D

For an **anterior puncture** of the shoulder joint, the arm is placed in a position of moderate abduction and slight external rotation. In this position the **coracohumeral ligament** is relaxed, and the **humeral head** is not tightly apposed to the **glenoid cavity** as it is when the arm is adducted. If the subject is not too muscular, it is easy to palpate the slight depression between the humeral head and the margin of the glenoid cavity while the arm is rotated at the shoulder. This depression marks the line of the joint space and the target of the puncture.

The **puncture site** is located one fingerwidth lateral to the tip of the coracoid process. The needle is inserted horizontally at that point with its tip directed slightly medially. Red pinheads mark the palpable bony prominences about the puncture site.

The most important bony landmark is the **tip** of the **coracoid process**. It lies just lateral to the **infraclavicular fossa** and is slightly overlapped by the medial border of the **deltoid muscle**.

After the needle has penetrated the **deltoid muscle**, it reaches the upper border of the **subscapularis muscle**, which covers the joint capsule in this area. The needle may first pierce the lateral border of the **short head** of the **biceps brachii muscle**, but it never poses a threat to major nerves and blood vessels.

The needle in this specimen has pierced the **middle glenohumeral ligament**. The **humeral head**, visible between that ligament and the **superior glenohumeral ligament**, has been separated from the glenoid cavity to the extent permitted by capsular restraint. In the living subject, the physiologic tonus of the periarticular muscles would prevent this degree of separation.



The arm is slightly abducted for a **posterior puncture** of the **shoulder joint**, as before, but slight **internal rotation** is used instead of external rotation to make the **humeral head** slightly more prominent and make it easier to palpate the joint space.

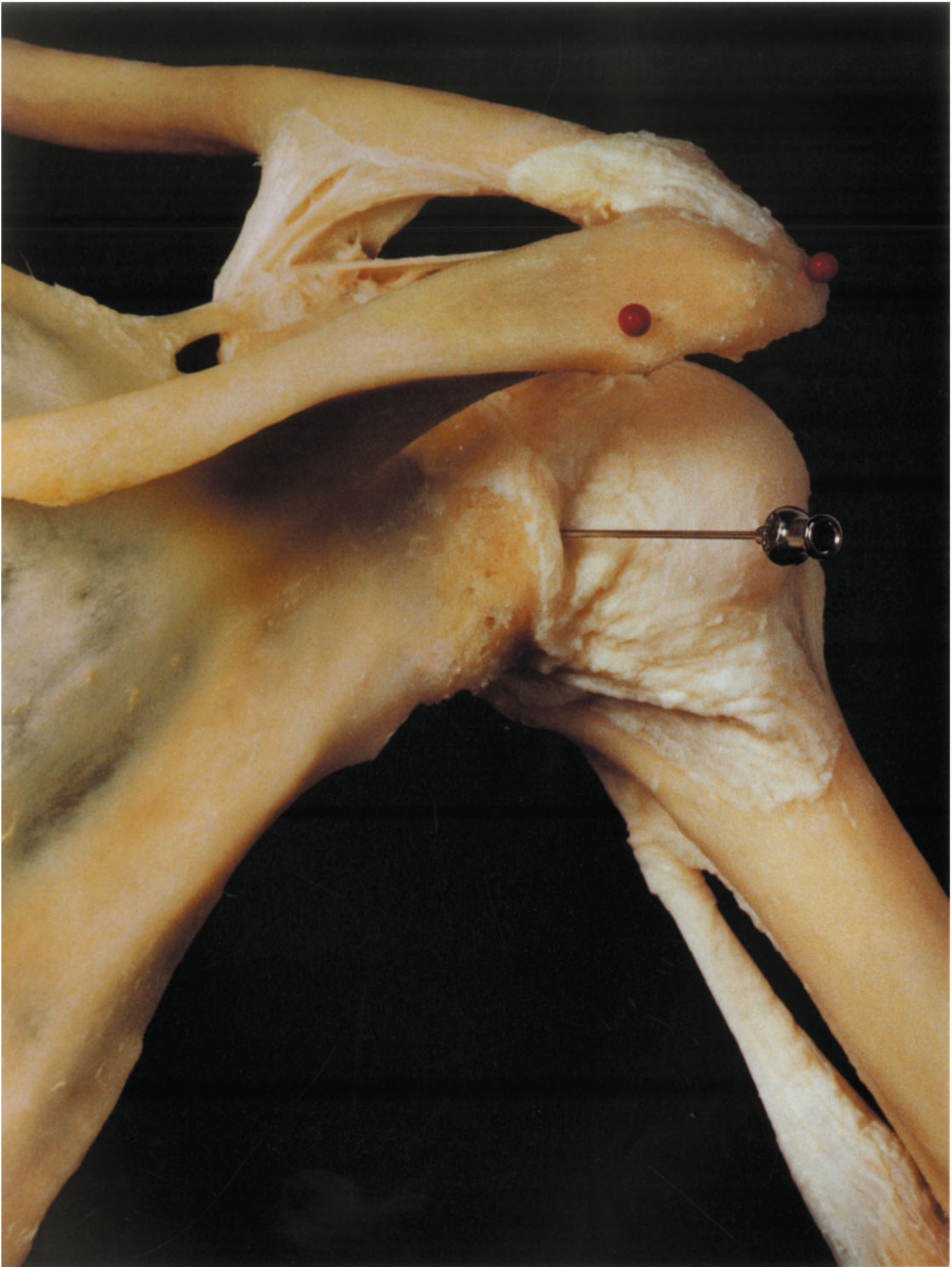
The needle is inserted horizontally and in a medial direction at a point slightly more than a thumbwidth below the **acromial angle**. The needle path skirts the posterior surface of the **humeral head** and reaches the margin of the **glenoid cavity** in line with the lateral border of the scapula.

After penetrating the skin, the needle pierces the part of the **deltoid muscle** arising from the scapular spine and the parts of the **infraspinatus muscle** and **teres minor muscle** that cover the joint capsule, passing approximately between these two muscles.

The **acromial angle**, marked with a red pinhead, is the site where the spine of the scapula becomes continuous with the lateral border of the acromion.

It is easy to palpate the **scapular spine** and **acromion**. As in the anterior puncture, however, the recommended technique is to **palpate** the **humeral head** and accurately determine its location while rotating the arm at the shoulder. The operator can feel how the **tuberosities** of the **humerus** move beneath the deltoid muscle and how the posterior part of the **humeral head** protrudes from the glenoid when the arm is internally rotated.

For either puncture, the arm should be flexed at the elbow and supported on a rest to relax the periarticular muscles and promote slight separation of the articular surfaces.



The **elbow joint** (cubital joint) is a **compound joint** consisting of the **humeroulnar articulation**, **humeroradial articulation**, and **proximal radioulnar articulation**. All the articulations are enclosed in a common **joint capsule**, which, apart from the collateral ligaments, is very thin and is very closely applied to portions of the articulating structures. As a result, the **capitulum** and **trochlea** of the **humerus** form prominent anterior bulges in the capsule. The **head** of the **radius** is also clearly defined.

Proximally, the **fibrous membrane** of the **joint capsule** covers the **coronoid** and **radial fossae** of the humerus. Between the **fibrous membrane** and **synovial membrane** in this area are thin fat pads that are pressed into the fossae during extension of the joint. Much larger fat pads on the posterior side of the joint are pressed into the **olecranon fossa** during flexion.

A very thin extension of the capsule, called the **sacciform recess**, is placed between the distal part of the joint space and the neck of the radius to permit rotational movements of the radius at the **radial annular ligament** during pronation and supination.

When the forearm is supinated as in the figure, its longitudinal axis deviates laterally from the humeral axis to a degree that is highly variable and depends very little on gender. This position of **physiologic abduction** is commonly known as the **carrying angle** of the elbow. It is based on the variable relationship of the articular surface of the humerus, radius, and ulna to the long axis of the upper limb.



This figure shows a posterior view of the extended **elbow joint** with the forearm in pronation. Red pinheads indicate the palpable bony landmarks about the joint. With the elbow extended, the **medial epicondyle** forms a straight line with the **lateral epicondyle** and the **olecranon** when viewed from behind. If viewed from the side, the olecranon would project behind the plane of the **posterior surface** of the **humerus**.

The **fat pad** that lies between the **synovial membrane** and **fibrous membrane** in the proximal part of the **olecranon fossa** has been mostly displaced from the fossa and the lower part of the capsule has been pushed together.

While thick muscles overlying the front of the elbow make the joint difficult to palpate from the anterior aspect, structural details are very easily palpated on the sides and posterior aspect of the joint. This particularly applies to the **epicondyles** of the **humerus**, which lie just beneath the skin.

Behind the **medial epicondyle**, the **ulnar nerve** can be palpated medial to the **olecranon** within the **ulnar groove** before it disappears between the two heads of the **flexor carpi ulnaris muscle**.

On the lateral side of the elbow, the **head** of the **radius** is easily palpated distal to the **lateral epicondyle**, along with the gap between the radial head and the **capitulum** of the **humerus**, because the extensor tendons arising from the lateral epicondyle in that area form a relatively thin layer that directly overlies the **radial collateral ligament** and is blended with it. The proximally adjacent space between the **olecranon** and the **lateral epicondyle** is occupied by the **anconeus muscle**, which in turn is covered by a thick fascia that is joined by an expansion from the **triceps brachii tendon**.



Panel A shows an elbow joint in a position of moderate flexion. The **humero-ulnar joint** is bridged by the **ulnar collateral ligament**, which passes from the **medial epicondyle** of the **humerus** to the margin of the **trochlear notch** of the **ulna**. The ligament consists of an **anterior** and a **posterior band** united by a somewhat thinner intermediate part. The anterior and posterior bands are attached to the ulna under cover of the **oblique ligament** of COOPER.

The bulge in front of the **ulnar collateral ligament** is the anterior border of the **trochlea** of the **humerus**, which is covered by a thin capsule. The channel of the trochlea articulates distally with the **coronoid process** of the ulna, which projects from the front of the bone proximal to the **ulnar tuberosity**.

The **oblique cord** arises from the lateral distal border of the **ulnar tuberosity** and attaches to an area of the **radius** that is volar to its **interosseous border** and distal to the **radial tuberosity**. It forms part of the ligamentous attachment between the radius and ulna that is continued distally as the **interosseous membrane** and mediates the transfer of compressive and tensile stresses from the radius to the ulna.

Panel B demonstrates the **radial collateral ligament**, which extends from the **lateral epicondyle** of the **humerus** toward the **annular ligament** of the **radius**. The latter structure arises from both sides of the **radial notch** of the **ulna** and encircles the **head** of the **radius**.

The **radial collateral ligament** is a very narrow band that may be largely replaced by the tendons of origin of the **extensor carpi ulnaris** and **extensor digitorum** muscles, with which it is intimately blended. It consists of an anterior and a posterior part that diverge and attach to the anterior and posterior margins of the **radial notch** of the **ulna**. Its most posterior fibers sometimes reach the origin of the **supinator muscle** on the supinator crest of the ulna. Only a small part of the radial collateral ligament blends with the **annular ligament** itself.



A



B

The **ulnar collateral ligament** functions as the collateral ligament of a hinge joint, so its primary task is to hold the articular surfaces together in response to sudden forces acting on the joint. The ligament also serves a much more highly differentiated function.

The ulnar collateral ligament is a triangular structure whose apex is attached to the **medial epicondyle** of the **humerus** and whose rounded base is attached to the margin of the **trochlear notch** of the **ulna**. Its broad anterior and posterior bands are united by a thinner intermediate portion and by the **oblique ligament** of COOPER.

Given the relatively large mass of connective tissue fibers that it conveys, the ligament is attached to the medial epicondyle of the humerus over a relatively broad area that overlaps the flexion axis. As a result, some of its fibers are taut while others are lax during hinge movements of the humeroulnar joint.

Panel A shows an elbow joint in **maximum flexion**. The **posterior band** of the **ulnar collateral ligament** is very tense in this position, while the **anterior band** is lax and bulges toward the observer. In the fully **extended** elbow in **Panel B**, the anterior band is taut while the posterior band is lax and slightly crumpled.

The tension of the anterior and posterior bands not only presses the articular surfaces more tightly together but also **restrains** articular motion, providing a soft-tissue shock-absorbing mechanism that becomes active in terminal flexion and extension of the forearm before motion is checked by the bony structures themselves, i. e., by impingement of the coronoid process or olecranon on the opposing fossae.

The broad area of attachment of the ulnar collateral ligament to the medial epicondyle would cause premature restraint or undesired laxity were it not for the **oblique articular surfaces** of the **humeral trochlea**. By slightly shifting the attachment of the tense ligament fibers toward their origin, the trochlear geometry compensates for inherent deficiencies in the tension-relaxation mechanisms of the ligaments.



A



B

The **articular cavity** of a slightly flexed **elbow joint** has been opened from the posterior aspect so that the relationship of the puncture needles to the articular surfaces (shown in the next figure) can be better understood.

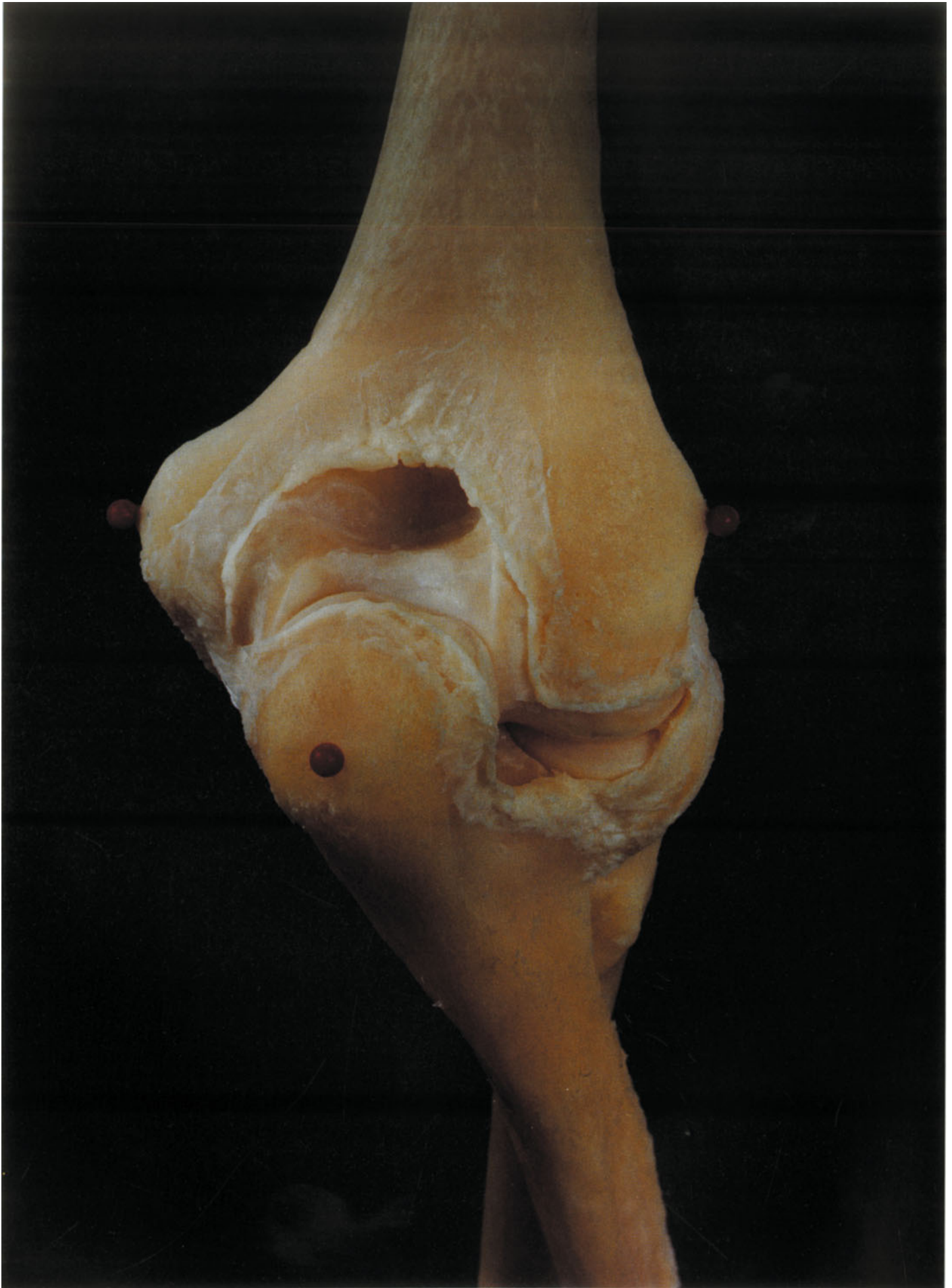
The posterior wall of the **joint capsule** between the **humerus** and **ulna** and between the **humerus** and superior margin of the **annular ligament** has been removed near its attachment, opening the space of the **humero-ulnar joint** and the communicating space of the **humero-radial joint** from the posterior side.

This has exposed the posterior part of the **trochlea** of the **humerus**, the apposing **trochlear notch** of the **ulna**, the **capitulum** of the **humerus**, and the **head** of the **radius** with the junction of its **articular circumference** and **articular fovea**. Above the **trochlea** is the part of the **olecranon fossa** that is lined with **synovial membrane**, narrow strips of which pass downward from the fossa on either side of the trochlea.

Within the joint capsule, the **articular circumference** of the **radial head** abuts the **radial notch** of the **ulna**, forming with it the **proximal radioulnar joint**. The intact **annular ligament** arises from the posterior margin of the notch.

Because the radius is in a position of extreme **pronation**, the **radial tuberosity** is just visible from the posterior aspect. The three bony prominences of the elbow – the **medial** and **lateral epicondyles** of the humerus and the **olecranon** – form an equilateral triangle owing to the flexed position of the elbow joint.

The **tip** or **beak** of the **olecranon** is covered with articular cartilage, so it always lies just inside the attachment of the capsule to the olecranon. By contrast, the capsular attachment to the **capitulum** of the **humerus** follows the border of that structure very closely. Only a small part of the **capitulum** is visible from the posterior side; it is placed more toward the front of the humerus so that it will maintain contact with the **articular fovea** of the **radial head** during maximum flexion.



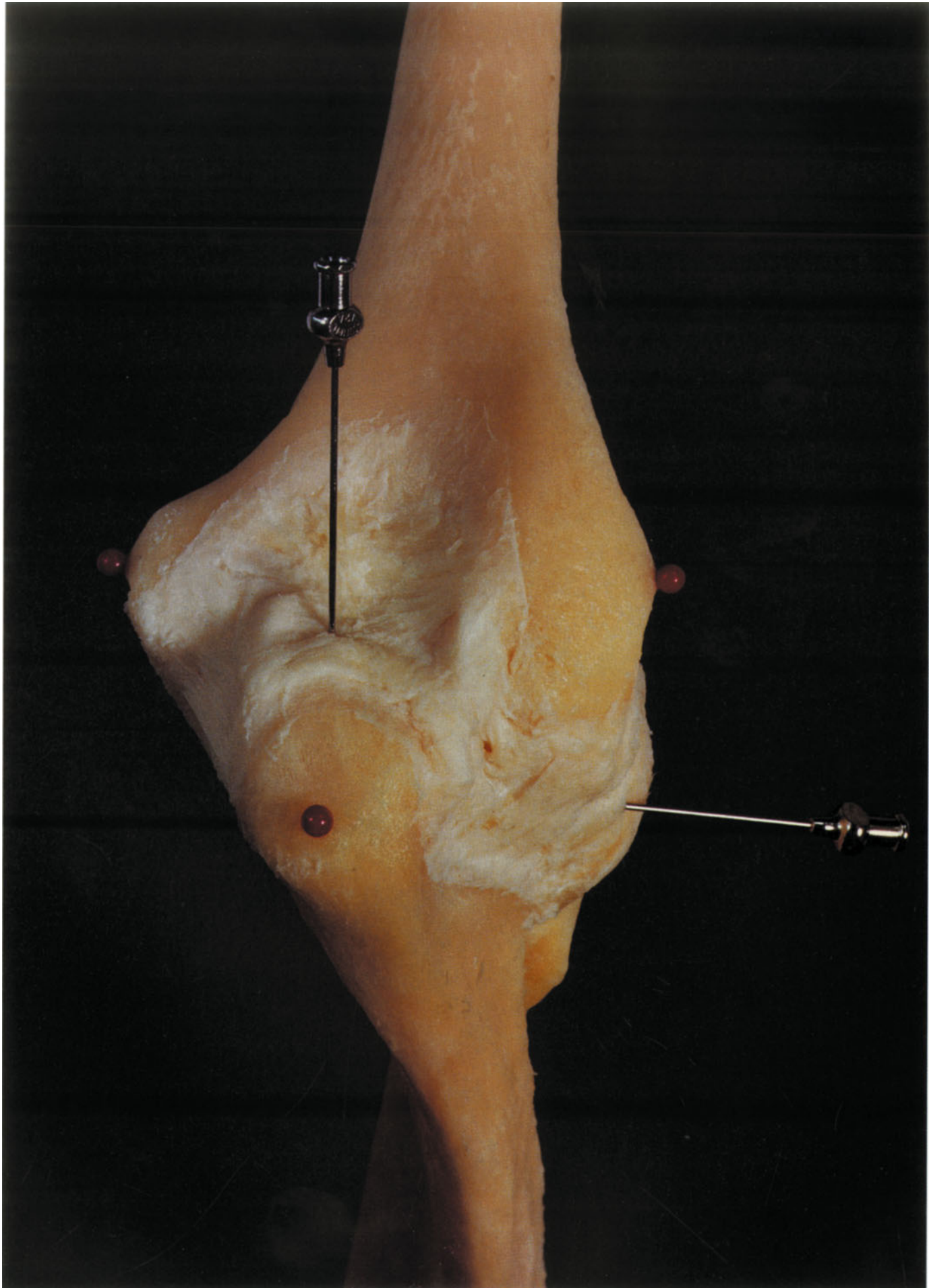
A **posterior puncture** of the **elbow joint** is performed with the arm in a flexed position. Various approaches are feasible in this region, because the back of the **humeroulnar joint** is covered only by the **medial head** of the **triceps brachii muscle** and its tendon of insertion, making the joint easily accessible from various sites.

Here we shall describe two posterior punctures at the center of the joint, although lateral oblique approaches could also be used.

Placing the elbow in a slightly flexed position exposes the upper portion of the **trochlea** of the **humerus**, which lies more or less perpendicular to a needle that is inserted horizontally just above the **olecranon**. To enter the joint space between the **trochlea** and the **trochlear notch** of the **ulna**, the needle should be directed downward when inserted, as shown in the figure.

The needle can also be directed slightly upward at this site, keeping on the same vertical plane, to target the superior end of the trochlea. In this technique the bevel of the needle is turned downward so that the tip will glide along the trochlear surface into the joint space. In the previous technique where the needle was directed downward, the bevel should be turned upward for the reasons explained in Fig. 200 of Vol. I.

For a **lateral puncture**, the needle is inserted into the **humeroradial joint** at the proper distance from the palpable **lateral epicondyle** of the **humerus**. It enters the space between the **capitulum** of the **humerus** and the **head** of the **radius**. This technique is described more fully in Fig. 195.



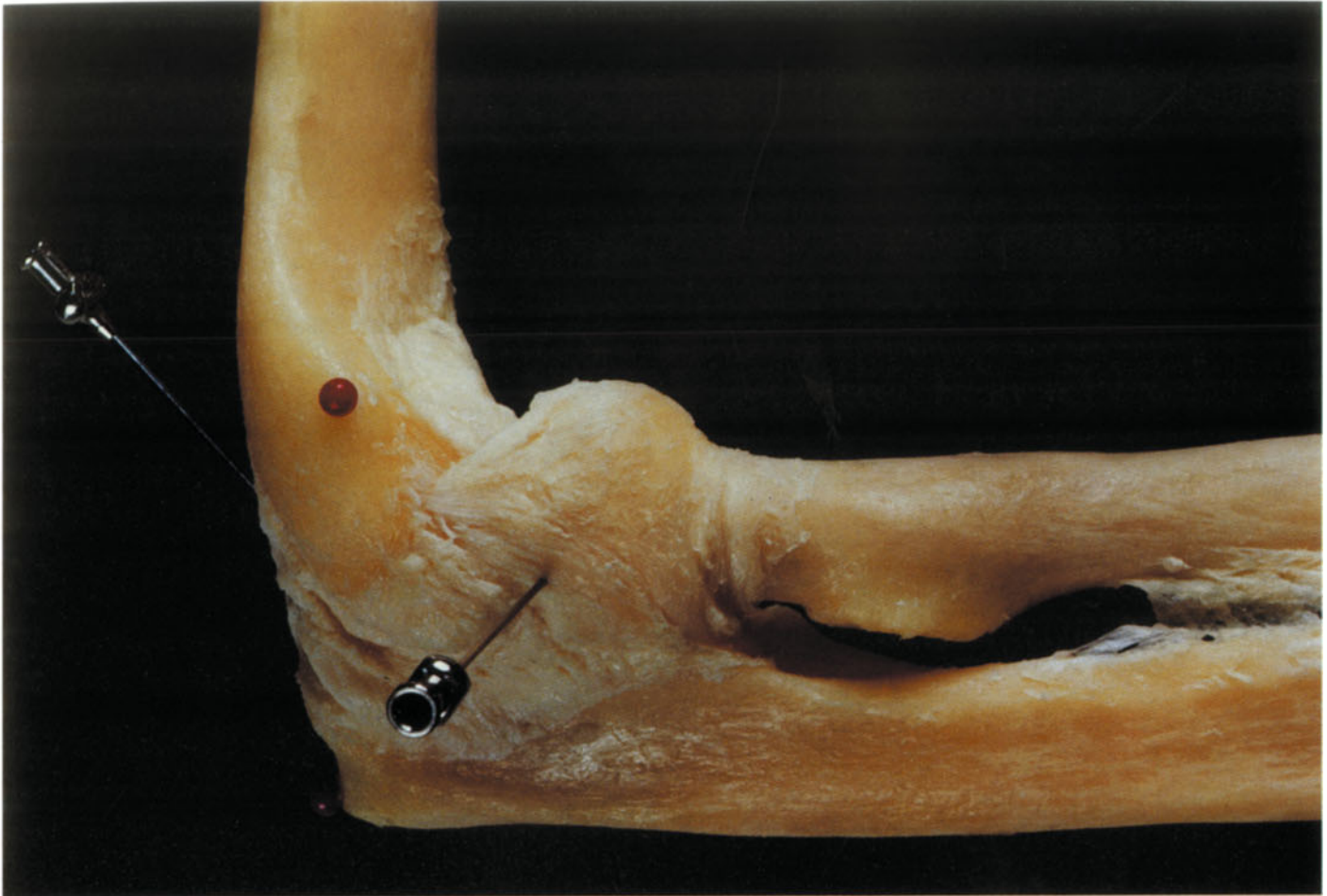
A **lateral puncture** of the **elbow joint** is performed with the arm flexed and targets the **humero-radial joint**. This joint space is easily palpated distal to the **lateral epicondyle** of the **humerus**, because the muscles that pass over the joint in that area, such as the **extensor digitorum** and **extensor carpi ulnaris**, have only relatively thin tendinous origins that overlie the joint capsule and overlap the **radial collateral ligament**.

When the needle is inserted distal to the **lateral epicondyle** as shown in **Panel A**, it pierces the joint capsule behind the **radial collateral ligament** and enters the space where the **head** of the **radius** begins to separate from the **capitulum** of the **humerus**. Posterior and medial to this insertion site is the **humero-ulnar joint space** between the **trochlea** of the **humerus** and the **trochlear notch** of the **ulna**.

In **Panel B**, an area devoid of cartilage and covered by synovial membrane is visible on the **trochlear notch** of the **ulna**, as is usually the case. The **trochlear notch** is continuous anteriorly with the **radial notch** of the **ulna**, which articulates with the **articular circumference** of the **radial head**. The **annular ligament** arises at the ulnar margin of the **radial notch**. The outer wall of the **saciform recess** has been removed at the distal border of the **annular ligament** to demonstrate the synovial reflection on the **neck** of the **radius**.

The **radial collateral ligament** is again seen to consist of two divergent parts, its **posterior part** being attached to the posterior margin of the **radial notch** of the **ulna**. It blends distally with the **annular ligament** of the radius.

In **Panel A**, as in the preceding figure, the needle has been inserted into the humero-ulnar joint space between the **trochlea** of the **humerus** and the **trochlear notch** of the **ulna** to show how steep the initial portion of the joint space is, even when the elbow is flexed to 90°.



A



B

The joints of the hand are numerous and diverse, consisting of the carpal joints, the carpometacarpal joints, and the joints of the fingers – the **metacarpophalangeal joints** and the **proximal** and **distal interphalangeal joints**. The interphalangeal joints are simple uniaxial hinge joints that have strong collateral ligaments.

The **metacarpophalangeal joints** are ellipsoidal joints whose capsule is attached dorsally near the chondro-osseous junction and is loosely blended with the **dorsal aponeurosis** of the fingers.

The **wrist joint** usually refers to the **radiocarpal joint**, although the principal hand movements occur in both the radiocarpal joint and the **midcarpal joint**, which is located between the proximal and distal rows of carpal bones.

The bones of the carpus are joined together by ligaments of varying length, known collectively as the **dorsal** and **palmar intercarpal ligaments**. They also receive long slips from the forearm bones, and some ligaments pass from the carpal bones to the metacarpus. This dense arrangement of the ligaments forms a **carpal cuff** that completely envelops the **wrist** and is uninterrupted, provided the sheet of connective tissue that covers the ligaments and contains the **dorsal carpal rete** has not been removed.

Even when the dorsal ligaments of the carpus have been fully exposed, there are only a few sites where portions of the carpal bones can be seen, i. e., the dorsal side of the **triquetral bone**, the dorsal side of the **trapezoid bone**, and a few other small areas.

The strongest ligament on the dorsal side of the wrist is the **dorsal radiocarpal ligament**, which extends from the posterior border of the **carpal articular surface** of the **radius** to the **triquetral bone**. This ligament limits the medial excursion of the proximal row of carpal bones when the hand is abducted, and it transmits pronatory movements from the forearm to the hand.

A curved fiber tract passes from the **triquetral bone** over the head of the **capitate bone** to the **scaphoid** and **trapezium**, continuing from there to the **trapezoid** and **capitate**. This part of the **dorsal intercarpal ligaments** has been called the **dorsal arcuate carpal ligament**.



This figure demonstrates the fibrocartilaginous **palmar ligaments** that cover the palmar surfaces of the **metacarpophalangeal joints**. They are firmly attached to the bases of the **proximal phalanges** and are continuous proximally and on the sides with the joint capsules. Their palmar surfaces are grooved to accommodate the long digital flexor tendons. The attachment of the **digital tendon sheath** to the sides of the groove has been severed. Stretching between the palmar ligaments are the **deep transverse metacarpal ligaments**, which blend proximally with the **deep palmar fascia** that covers the **interosseous muscles**. This ligament apparatus binds the **heads** of the **metacarpal bones** together and provides attachment for the deep slips of the palmar aponeurosis.

The first and second metacarpal bones are not interconnected by transverse ligaments. The capsule of the **metacarpophalangeal joint** of the **thumb** contains two **sesamoid bones** that lie in shallow grooves on the head of the first metacarpal.

The **interphalangeal joints** are covered by similar **palmar ligaments**, which have been resected in this specimen to demonstrate the **trochleae** of the phalanges.

The **carpal groove** on the palmar surface of the **carpus** is flanked by two prominences called the carpal eminences. The **ulnar carpal eminence** is formed by the **pisiform bone** and the **hook** (hamulus) of the **hamate bone**, and the **radial carpal eminence** by the **tubercle** of the **scaphoid bone** and by the **trapezium**.

The **radial carpal eminence** is traversed by a canal formed by the attachment of the **flexor retinaculum** [transverse carpal ligament] that bridges the carpal groove. It transmits the tendon of the **flexor carpi radialis** to the base of the third metacarpal bone.

At the center of the **carpal groove** is the **capitate bone**. The fascicles radiating from the head of the capitate to the surrounding bones are called the **radiate carpal ligament**. Just proximal to that ligament are the **palmar radiocarpal ligament**, which sends a broad slip to the lunate bone, and the **palmar ulnocarpal ligament**.



The **radiocarpal joint** and **midcarpal joint** have been opened from the dorsal side by dividing the **joint capsule** and the attached ligaments.

The **joint capsule** is attached near the chondro-osseous junction, leaving the non-cartilage-bearing dorsal and palmar surfaces of the carpal bones outside the joints. The carpal bones in the proximal row have narrow dorsal surfaces and broad palmar surfaces, while the distal row of carpal bones are broad dorsally and narrow on the palmar side.

The **radiocarpal joint** is an ellipsoidal joint whose proximal surface is formed by the **carpal articular surface** of the **radius**. This surface is divided in two by a low ridge and is supplemented on the ulnar side by the **articular disc**.

The **articular disc** is a triangular, biconcave plate of fibrocartilage that extends from the margin of the **ulnar notch** of the radius to the **styloid process** of the ulna. Placed between the radiocarpal joint and **distal radioulnar joint**, the disc may form a complete partition separating the two joints, but often it has an elliptical or slitlike perforation through which the joints communicate.

The **distal articular surface** of the **radiocarpal joint** is formed by the proximal row of carpal bones, consisting of the **scaphoid**, **lunate** and **triquetral bones**. These three bones are interconnected by **interosseous intercarpal ligaments**, which are located at the proximal end of the spaces separating the bones and are covered by fibrocartilage on their exposed surfaces.

This arrangement creates a very simple joint space, which usually is isolated unless there is a small opening in the **interosseous intercarpal ligaments** through which it communicates with the midcarpal joint. Not infrequently, it connects with the joint between the pisiform and triquetral bones or, as mentioned, with the distal radioulnar joint.

The **midcarpal joint** is located between the proximal and distal rows of carpal bones, but the **interosseous intercarpal ligaments** do not completely separate it from the **carpometacarpal joints**. These joints communicate in turn with the **intermetacarpal joints**, resulting in a complicated and extensive joint space. Only the **carpometacarpal joint** of the **thumb** has its own separate articular cavity.



The **degrees of freedom** in the **wrist joint** are theoretically like those in an **ellipsoidal joint**, which would permit movements of flexion (palmar flexion), extension (dorsi-flexion), abduction (radial deviation), and adduction (ulnar deviation).

In reality, the function of a single biaxial joint is assumed by two uniaxial joints that work like a **universal joint**, as ligamentous constraints greatly limit the capacity of the roughly ellipsoidal radiocarpal joint to undergo medial or lateral displacement.

Panel A shows a dorsal view of the right hand in **full abduction**. The concave side of the midcarpal joint attempts to displace the **scaphoid** medially, but the proximal row of carpal bones can follow this movement only slightly due to the restraining action of the **dorsal radiocarpal ligament**. This forces the anterior end of the **scaphoid** to move in a palmar direction, occupying a position that, as **Panel B** shows, is almost perpendicular to the long axis of the forearm. Accompanying this palmar displacement of the **scaphoid** is a reciprocal dorsal displacement of the **triquetral bone**.

Thus, **abduction** of the hand is associated with palmar flexion, pronation, and slight medial displacement of the **proximal row of carpal bones**. This movement takes place about the **first axis of HENKE**, which enters the wrist on the posterior side of the radius, proximal to the styloid process, and exits on the palmar side of the pisiform bone.

The palmar flexion of the proximal row of carpal bones in the abducted hand is offset by a concomitant **dorsiflexion** and supination of the **distal row of carpal bones**. These bones move about the **second axis of HENKE**, which enters the wrist on the dorsal side of the hamate bone and exits on the palmar side of the scaphoid tubercle.

During **adduction** of the hand, the proximal row of carpal bones undergo an opposite set of movements. Tension from the **radial carpal collateral ligament** on the apex of the **scaphoid** and pressure on the **triquetral bone**, which moves toward the palm, cause the **scaphoid** to assume a longitudinal orientation as shown in **Panel D**.



A



C



B



D

Palmar flexion and **dorsiflexion** of the **hand** also occur at both the radiocarpal and midcarpal joints, but the midcarpal joint moves in the same direction as the radiocarpal joint, accentuating its degree of flexion or extension.

This is a major factor in the large **range of flexion-extension** at the wrist, which is almost 90° in both directions. The carpal joints make varying contributions to these movements, with **palmar flexion** occurring mainly at the radiocarpal joint while **dorsiflexion** occurs mainly at the midcarpal joint.

As a result, in **palmar flexion** the **proximal row of carpal bones** forms a slight distal prolongation of the forearm before there is perceptible angulation at the wrist. This contrasts with **dorsiflexion**, in which the dorsum of the hand angles sharply away from the forearm at the distal border of the radius. This occurs because the **proximal row of carpal bones** rotates fully into the concavity of the **radius** while the strong dorsiflexion at the midcarpal joint apposes the **distal row** of carpal bones to the border of the radius.

To make it easier to compare these two configurations, we have superimposed an extension view of the hand, with the volar side of the forearm upward (left), over a flexion view of the same hand (right).

The position of the radius in the **extended wrist** indicates that the excursion of the hand under its own weight is less than in the flexed wrist, but otherwise the two movements have the same approximate ranges. Thus, when the hand is moved to an extreme position, resistance is encountered earlier in dorsiflexion than in palmar flexion. This is due in part to the volar obliquity of the **carpal articular surface** of the radius, which explains why the **neutral position** of the wrist is a position of slight flexion.



A **distal radial fracture** and **lunate dislocation** are typical injuries caused by a fall onto the hyperextended wrist. As the **wrist** and its ligaments play a key role in these injuries, they will be displayed with the hand in the dorsiflexed position.

The **palmar radiocarpal ligament** is a very strong ligament that extends from the palmar border of the **carpal articular surface** of the **radius** to the **capitate bone** and the **lunate bone**.

The broad attachment of the ligament to the palmar surface of the **lunate bone** can exert considerable traction on the lunate bone when the wrist is forced into extreme **dorsiflexion**. This force, combined with pressure from the surrounding carpal bones, can tear the lunate from its attachments, which consist mainly of the **interosseous intercarpal ligaments**. This injury is facilitated by the physiologic palmar projection of the lunate bone in the extended wrist, as the figure shows.

On the other side of the joint, the **radial** attachment of the thick **palmar radiocarpal ligament** can exert powerful traction on the distal border of the radius during a fall onto the dorsiflexed wrist. When combined with a shearing action on the projecting dorsal border of the radius, this can produce a typical avulsion fracture of the distal radius.

The **palmar ulnocarpal ligament** is another powerful ligament that extends to the capitate bone from the **articular disc** and from the **styloid process** of the **ulna**. It combines with the **palmar radiocarpal ligament** to form a ligamentous arch over the proximal part of the **capitate bone**. This arch is bordered distally by the **radiate carpal ligament**, which assists the **palmar intercarpal ligaments** in binding together the distal row of carpal bones.

The powerful **palmar carpometacarpal ligaments** pass from the distal row of carpal bones to the bases of the metacarpal bones and are especially well developed about the **third metacarpal**. With the exception of the fourth and fifth metacarpals, these bands create a very strong **amphiarthrosis** that prevents motion relative to the carpus.

This specimen clearly shows the **carpal groove** bordered by the **carpal eminences**, which are formed on the medial side by the **hook** of the **hamate bone** and the **pisiform bone** and on the lateral side by the **tubercle** of the **scaphoid** and the **trapezium**.



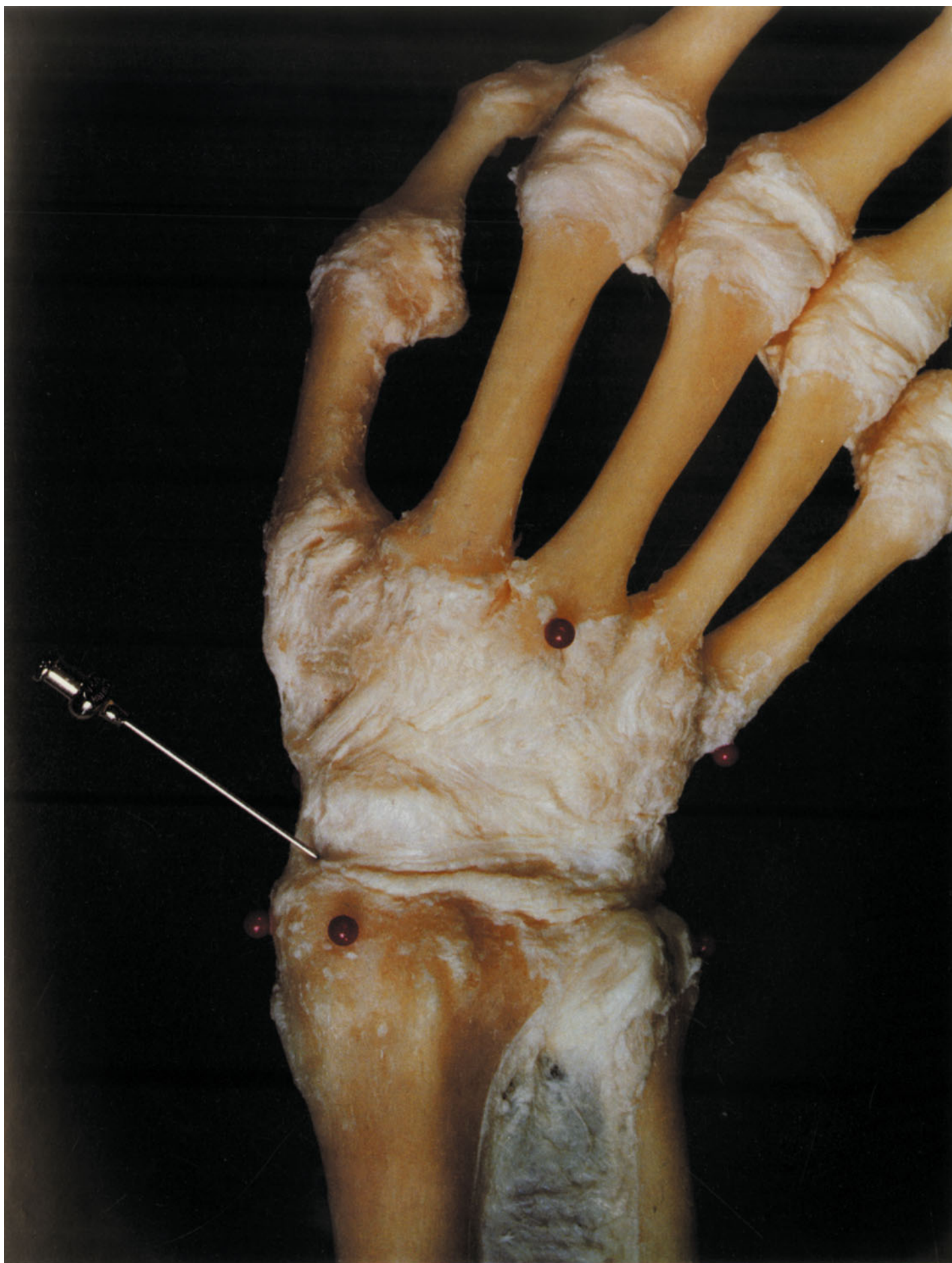
Red pinheads in this and the following specimens indicate the main palpable bony landmarks about the wrist: the **styloid process** of the **ulna**, the anterior and posterior borders of the **styloid process** of the **radius**, and the **base** of the **third** and **fifth metacarpal bones**. If the anatomy of the hand is known, the palpable bony and tendinous structures should make it relatively easy to direct a needle into a specific joint.

The figure illustrates the simplest procedure, a **radial puncture** of the **radiocarpal joint**. With the hand positioned in full **adduction**, the **scaphoid bone** assumes a longitudinal orientation and is easily accessible between the **radius** and **trapezium**. A bulge in the capsule indicates the position of the scaphoid in the figure.

The needle is inserted just distal to the **styloid process** of the **radius**. With the needle directed proximally, it should be easy to enter the space between the **carpal articular surface** of the **radius** and the surface of the **scaphoid bone** that articulates with it. The target is the articular surface of the scaphoid. The bevel of the needle should face that surface, as this will facilitate entry of the needle tip into the joint space.

The needle should be inserted very close to the styloid process of the radius to avoid injury to the **radial artery**, which crosses from the palmar to the dorsal side of the hand in this area. Thus, before inserting the needle, the operator should palpate the exact position of the distal border of the **styloid process** while the hand is being abducted and adducted.

Ulnar puncture of the **radiocarpal joint** is performed with the hand in abduction (see Figs. 204 and 205).



This specimen shows how the **radial puncture** of the **radiocarpal joint** relates to the surrounding tendons and tendon sheaths. The needle has been inserted just in front of the styloid process in the **radial foveola** [anatomic snuffbox].

When the thumb is abducted and extended, the tendons of the **extensor pollicis longus**, **extensor pollicis brevis**, and **abductor pollicis longus** become prominent and define the boundaries of the **radial foveola**. These tendons are enclosed in **tendon sheaths** whose distal ends show a typical arrangement at the wrist.

The **needle** lies between the tendon sheaths and is directed proximally so that it can enter the joint space between the **scaphoid bone** and the **carpal articular surface** of the **radius**. The hand has been **adducted** to open up the joint space on the radial side and to maximize the target area of the scaphoid bone distal to the radius (see Fig. 198).

Stretching from the radius to the ulna and the ulnar border of the wrist is the **extensor retinaculum** [dorsal carpometacarpal ligament] with its tendon sheath compartments, which do not pose a serious obstacle to a needle that is inserted distal to the radius. Thus the **radiocarpal joint** is accessible to **radiodorsal** and **ulnodorsal punctures**, which are performed with the hand in palmar flexion.

The site for a **radiodorsal puncture** is located at the distal border of the radius between the **extensor pollicis longus tendon** and the **extensor digitorum tendon** to the **index finger**. The site for an **ulnodorsal puncture** is between the tendons of **extensor digiti minimi** and **extensor carpi ulnaris**, using the palpable **extensor digiti minimi tendon** as a guide. Because it is not always easy to avoid piercing tendons and tendon sheaths in these procedures, the main purpose of the figure is to illustrate the **radial puncture**.



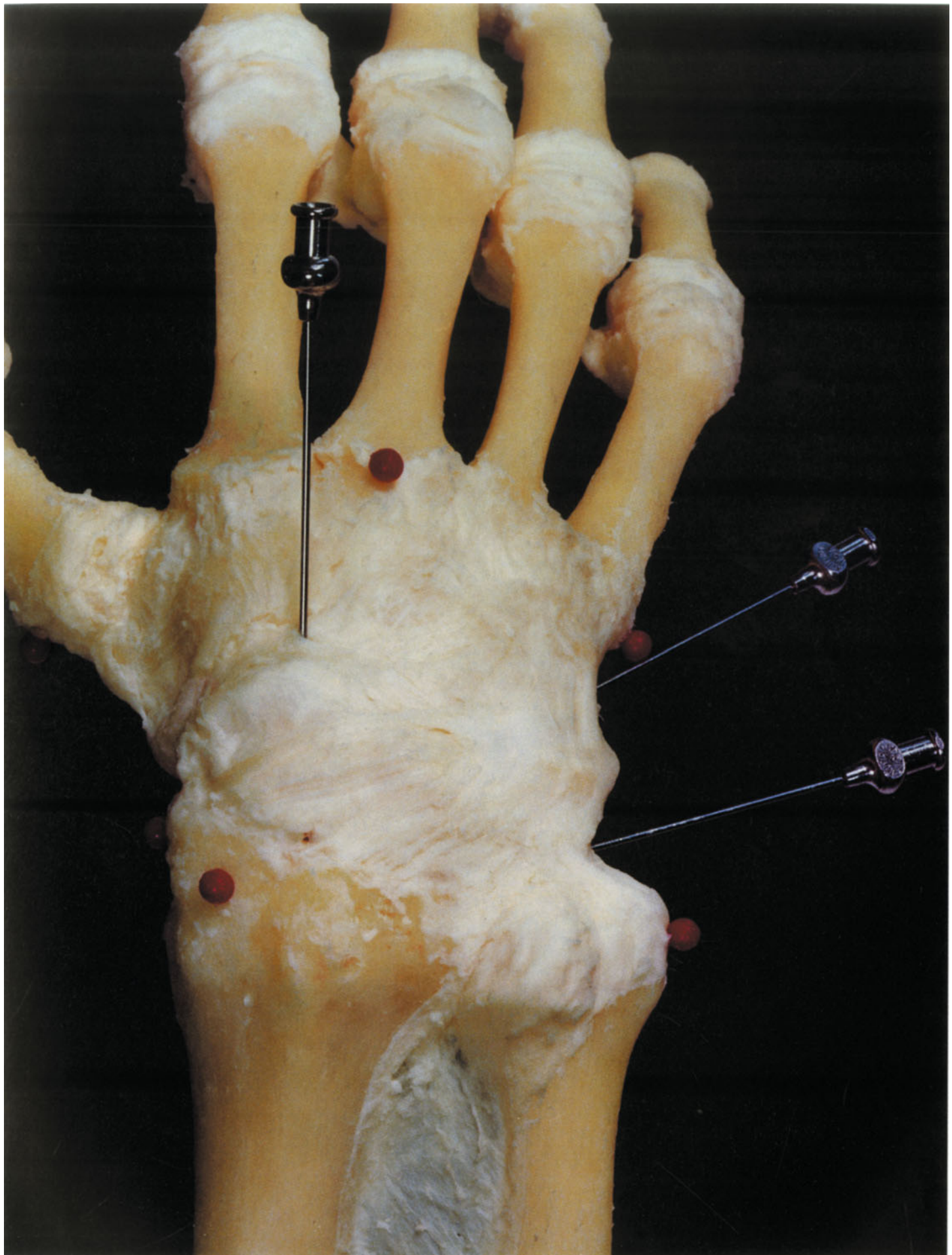
Ulnar punctures of the **radiocarpal** and **midcarpal joints** are performed with the hand in **abduction** to open up the joint spaces on the ulnar side and to separate the **triquetral bone** from the articular disc (see Fig. 199).

For an **ulnar puncture** of the **radiocarpal joint**, the needle is inserted between the **pisiform bone** and the **styloid process** of the **ulna** and advanced in a slightly proximal direction. The bevel should face the proximal articular surface of the **triquetral bone**, which is the **target** of the puncture. The tip of the needle should glide along this surface, following the general technique described in Fig. 200 of Vol. I.

For an **ulnar puncture** of the **midcarpal joint**, the needle is inserted between the **pisiform bone** and the **base of the fifth metacarpal bone**. The target is the proximal articular surface of the **hamate bone**. Again, the bevel of the needle should face the target surface, resulting in a slightly more oblique line of insertion.

For a **dorsal puncture** of the **midcarpal joint**, the needle is inserted between the **capitate bone** and **scaphoid bone**, aiming at the narrow longitudinal space on the radial side of the capitate bone (shown in Fig. 197). There should be no resistance to the puncture even if the needle passes slightly too far distally, because the joint space extends distally and connects directly with the **intercarpal joint space** between the **capitate** and **trapezium**.

The **puncture site** on the dorsum of the carpus is just proximal to the **base of the third metacarpal bone**, which is easily palpated and whose palpable **styloid process** is a useful guide for locating the radial margin of the **capitate bone**. Thus, the needle is inserted in a proximal, volar direction just radial to the **styloid process** of the **third metacarpal**. A position of slight **palmar flexion** is recommended for the procedure.



This specimen demonstrates the **relation** of the **puncture sites** in the previous figure to the tendons and tendon sheaths. The hand is slightly abducted to open up the joint spaces on the ulnar side of the wrist.

For an **ulnar puncture** of the **radiocarpal joint** between the pisiform bone and the styloid process of the ulna, the needle passes between the tendons of the **extensor carpi ulnaris** and **flexor carpi ulnaris**.

Despite their proximity to each other, both tendons can be accurately identified by palpation, especially when the hand is actively abducted and adducted. The **tendon** of the **flexor carpi ulnaris** is readily identified by its attachment to the **pisiform bone** and becomes slightly more prominent on palmar flexion of the hand. The **extensor carpi ulnaris tendon** is palpable during wrist movements, but it can also be identified by its characteristic relationship to the styloid process and head of the ulna. By placing a fingernail between the two tendons, the operator can feel the gap into which the needle should be inserted.

A similar depression can be felt distal to the pisiform bone. It is palmar to the characteristic **attachment** of the **extensor carpi ulnaris tendon** to the **base** of the **fifth metacarpal bone** and is available for an **ulnar puncture** of the **midcarpal joint**.

A **dorsal puncture** of the **midcarpal joint**, described in the previous figure, bypasses the **tendon** of the **extensor carpi radialis brevis muscle** on the radial side because that tendon is attached to the **base** of the **third metacarpal bone**. Generally the puncture does not reach the **tendon sheath**, which ends about 10 cm proximal to the base of the metacarpal.

The site indicated between the sheaths of the **extensor digiti minimi** and **extensor carpi ulnaris** tendons corresponds to the site for an **ulnodorsal puncture** of the **radiocarpal joint** mentioned in Fig. 202. It should be noted that pronation of the hand greatly increases the distance between the two tendons, because the tendon is attached to the radius and not to the capsule of the **distal radioulnar joint**.



Figure 49
(continued)

Bony Anatomy of the Orbit and Middle Cranial Fossa

The thin bony wall between the **orbit** and **temporal fossa** – formed by a posterior extension of the **zygomatic bone** and an anterior extension of the **greater sphenoid wing** – has been resected along with the **orbital margin** of the **zygomatic bone**. The remaining posterior part of the greater sphenoid wing separates the **middle cranial fossa** from the **orbit**.

The **middle cranial fossa** has been opened laterally by removing the posterior extension of the lateral part of the **greater sphenoid wing** and an adjacent portion of the **squamous part** of the **temporal bone**.

A **bony bridge** has been left intact above the **inferior orbital fissure**, connecting the lower edge of the bony **temporal window** with the remaining part of the **zygomatic bone**.

Within the boundaries of the temporal window, the **frontal branch** of the **middle meningeal artery** occupies a **canal** in the posterosuperior corner of the **greater sphenoid wing**. Above the lower edge of the bony window, the **middle meningeal artery** gives off an **orbital branch** that enters the **orbit** through the **superior orbital fissure** and anastomoses with the **lacrimal artery** or gives origin to it. All of the **ophthalmic artery** may occasionally arise from the orbital branch.

With the bony orbit opened, most of the **periorbita** has been removed. The posterior remnant has been slightly elevated from the bone. It is continuous anteriorly with the **periosteum** of the **orbital margin**. This junctional strip has been reflected and held forward with two threads.

Autonomic Nerve Supply within the Orbit

The **orbit** is traversed by autonomic nerves, including some independent nerve pathways, that supply the eyeball and the lacrimal gland. In the **eyeball**, autonomic fibers are distributed to the smooth muscle tissue of the **iris** and **ciliaris**.

The **ciliary ganglion** supplies the **ciliaris** and **sphincter pupillae muscles** with **short ciliary nerves**, which pass to the **eyeball** near the **optic nerve** and are responsible for ac-

commodation and **pupillary constriction** in response to light. They pierce the **sclera** and pass to the muscles in the **perichoroidal space**. Two of the three to six branchlets of the **short ciliary nerves**, which undergo multiple divisions outside and inside the globe, are visible on the outer sheath of the optic nerve.

The **ciliary ganglion**, which is lateral to the **optic nerve** and just hidden by the remnant of the **periorbita**, receives a parasympathetic, sympathetic, and sensory root in this area.

The two fine **long ciliary nerves** arise from the **sensory nasociliary nerve** proximal to the ciliary ganglion and lie on the **outer sheath** of the **optic nerve**. They pierce the sclera at a somewhat more anterior site but are difficult to see without further magnification. They also carry sympathetic fibers that join with the sympathetic fibers of the short ciliary nerves in supplying the **dilatator pupillae muscle**.

The **lacrimal gland** is supplied with secretory fibers from the **pterygopalatine ganglion** via the **zygomatic nerve**, which is connected to the **lacrimal nerve** by a **communicating branch**. This branch connects with the superior branch of the zygomatic nerve, the **zygomaticotemporal branch**, usually before it enters the homonymous foramen of the zygomatic bone.

Bibliography

- Adachi B (1928) Das Arteriensystem der Japaner. Universitätsverlag, Kyoto
- Adachi B (1933) Das Venensystem der Japaner. Druckanstalt Kenkyusha, Tokio
- Adelmann G (1874) Die Beugung der Extremitäten als Blutstillungsmittel. Arch. klin. Chir. 16, Berlin
- Anson BJ, Maddock WG (1958) Callander's Surgical Anatomy. Saunders Company, Philadelphia London
- Bardeleben K v, Haeckel H, Frohse F (1908) Atlas der topographischen Anatomie des Menschen. 4th Ed. Fischer, Jena
- Bargmann W (1962) Histologie und mikroskopische Anatomie des Menschen. Thieme, Stuttgart
- Bartels P (1909) Das Lymphgefäßsystem. Handbuch der Anatomie des Menschen von Bardeleben. Fischer, Jena
- Braune CW (1884) Das Venensystem des menschlichen Körpers. I. Die Venen der vorderen Rumpfwand des Menschen. Veit, Leipzig
- Braus H (1954) Anatomie des Menschen. 3rd Ed. Springer, Berlin Göttingen Heidelberg
- Cairney J (1924) Tortuosity of the cervical segment of the internal carotid artery. J. Anat. (Lond) 59
- Carr BW, Bishop WE, Anson BJ (1942) Mammary Arteries. Quart. Bull. Northw. Univ. Med. School 16
- Chandler GB, Derezinski CF (1935) The variations of the middle marginal artery within the middle cranial fossa. Anar Rec. 62
- Chevrel JP (1996) Anatomie clinique. Springer, Berlin Heidelberg New York
- Clara M (1959) Das Nervensystem des Menschen. 3rd Ed. Barth, Leipzig
- Cooper AP (1840) On the Anatomy of the Breast. Vol. 2. Longmans, Harrison, London
- De Palma AF, Callery G, Bennett GA (1949) Variations in the opening of the subscapular bursa. Am. Acad. Orth. Surgeons Instruct. Course Lectures 6
- Eisler P (1912) Die Muskeln des Stammes. In: Handbuch der Anatomie des Menschen von Bardeleben. Fischer, Jena
- Elze C (1961) Die anatomischen Grundlagen der Headschen Zonen. Zschr. Anat.-Entwgesch. 122, Springer, Berlin Göttingen Heidelberg
- Fick R (1904) Anatomie der Gelenke. In: Handbuch der Anatomie und Mechanik der Gelenke von Bardeleben. Fischer, Jena
- Foltz (1860) Anatomie et physiologie des Conduits lacrymanx. Ann d'oculistique (zit. nach Graefe und Saemisch (1874)). Handbuch der Augenheilkunde. Wilhelm Engelmann, Leipzig

-
- Forster A (1904) Ueber die morphologische Bedeutung des Wangenpfropfes. Seine Beziehung zu den Kaumuskeln und zur Glandula orbitalis. Arch. Anat u. Physiol. Veit, Leipzig
- Frohse F, Fränkel M (1908) Die Muskeln des menschlichen Arms. In: Handbuch der Anatomie des Menschen von Bardeleben. Fischer, Jena
- Gänshirt H (1972) Der Hirnkreislauf. Thieme, Stuttgart
- Gerota D (1897) Nach welchen Richtungen kann sich der Brustkrebs verbreiten? Arch. klin. Chirurg 54, Berlin
- Gray's Anatomy (1989) 37th Ed. Churchill Livingstone, Edinburgh London Melbourne New York
- Grayson J (1941) The cutaneous ligaments of the digits. J. Anat 75
- Grodinsky M, Holyoke EA (1938) The fasciae and fascial spaces of the head, neck and adjacent regions. Amer. J. Anat. 63
- Grossmann (1896) Ueber die Lymphdrüsen und -bahnen der Achselhöhle. Preisschr. Berlin
- Gruber W (1861) Die supernummerären Brustmuskeln des Menschen. Bull. Acad. Imp. Sc. St. Pétersbourg 7 Sér. T. 3
- Hafferl A (1969) Lehrbuch der topographischen Anatomie. 3rd Ed. Springer, Berlin Heidelberg New York
- Hansen K, Schliack H (1962) Segmentale Innervation. Thieme, Stuttgart
- Head H (1898) Die Sensibilitätsstörungen der Haut bei Viszeralerkrankungen (Deutsch von W. Seiffer). Hirschwald, Berlin
- Head H (1893/1894) On disturbances of sensation with especial reference to the pain of visceral disease. Brain 16, 17, London
- Henke W (1859) Ueber die Bewegung der Handwurzel. Zschr. rat. Med. 7
- Henle J (1871) Handbuch der systematischen Anatomie des Menschen. Vieweg, Braunschweig
- Hollinshead WH (1961) Anatomy for Surgeons. 3rd Ed. Hoeber-Harper Book, New York
- Hovelaque A (1927) Anatomie des Nerfs craniens et rachidiens et du Système Grand Sympathique chez l'Homme. Gaston Doin, Paris
- Huebner HJ (1967) Zum Verlauf der A. carotis interna im Bereich des Halses. Anat. Anz. 121. Fischer, Jena
- Hurford FR (1946) The surgical anatomy of the parotid gland. Brit. J. Surg. 34
- Hyrthl J (1862) Ueber den Porus crotaphitico-buccinatorius beim Menschen. Sitzb. d. Kaiserl. Akad. d. Wissensch. zu Wien. Naturw. Math. Klasse XLVI
- Jossifow GM (1930) Das Lymphgefäßsystem des Menschen. Fischer, Jena
- Kalbfleisch H, Hort W (1976) Verteilungsmuster der Koronararterien (Versorgungstypen) des menschlichen Herzens. Dtsch. Med. Wschr. 101
- Koch W (1912) Zur Anatomie und Physiologie der intracardialen motorischen Zentren des Menschen. Med. Klinik
- Krause W (1909) Skelet der oberen und unteren Extremität. In: Handbuch der Anatomie des Menschen von Bardeleben. Fischer, Jena

-
- Krause W (1865) Beiträge zur Neurologie der oberen Extremität. Winter, Leipzig
- Kretschmann HJ, Kaltenbach M (1970) Anatomy Nomenclature of Coronary Arteries in Coronary Heart Disease. Kaltenbach M, Lichten P. Stuttgart
- Krönlein RU (1886) Deutsch. Z. Chir. 23. Springer, Berlin
- Langer C (1846) Zur Anatomie des M. latissimus dorsi. Österr. med. Wochenschr. Braumüller & Seidel, Wien
- Langer C (1861) Zur Anatomie und Physiologie der Haut. Sitzungsab. Acad. Wissensch. 45, Wien
- Lanz T von, Wachsmuth W (1935) Praktische Anatomie. Bd I Teil III, Arm. Springer, Berlin Göttingen Heidelberg
- Lanz T von, Wachsmuth W (1955) Praktische Anatomie. Bd I Teil II, Hals. Springer, Berlin Göttingen Heidelberg
- Lanz T von, Wachsmuth W (1985) Praktische Anatomie. Kopf. Springer, Berlin Heidelberg New York Tokyo
- Lanz T von, Wachsmuth W (1982) Praktische Anatomie. Bd II, Teil 7, Rücken. Springer, Berlin Heidelberg New York
- Learmonth JR (1919) A variation in the distribution of the radial branch of the musculospiral nerve. J. Anat 53
- Le Double AF (1897) Traité des Variations du Système musculaire de L'Homme. Vigot Frères, Éd., Paris
- Lippert H, Pabst R (1985) Arterial variations in man. Classification and frequency. Bergmann, München
- Loth E (1917) Varietäten der A. cervicalis profunda und der A. cervicalis superficialis. Travaux de la Société des Sciences de Varsovie III. Classe des sciences mathématiques et naturelles 24
- Luschka H (1854) Der lange Halsmuskel des Menschen. J. Müllers Arch.
- Manchot C (1889) Die Hautarterien des menschlichen Körpers. Vogel, Leipzig
- Marcus GH (1934) Untersuchungen über die arterielle Blutversorgung der Mamilla. Langenbecks Arch. klin. Chir. 179
- McCarthy JG (1990) Plastic Surgery. Bd. I. Saunders Company, Philadelphia
- McKenzie J (1948) The parotid gland in relation to the facial nerve. J. Anat 42
- McWharton GL (1917) The relations of the superficial and deep lobes of the parotid gland to the ducts and to the facial nerve. Anat. Rec. 12
- Merkel F (1874) Makroskopische Anatomie. In: Handbuch der gesamten Augenheilkunde. Engelmann, Leipzig
- Merkel F (1885–1890) Handbuch der topographischen Anatomie. Vieweg und Sohn, Braunschweig
- Morris HMA, Lond MB (1893) A Treatise on Human Anatomy. Churchill, London
- Most A (1906) Topographie des Lymphgefäßapparates des Kopfes und des Halses in ihrer Bedeutung für die Chirurgie. Hirschfeld, Berlin
- Most A (1908) Untersuchungen über die Lymphbahnen der oberen Thoraxapertur und am Brustkorb. Arch. f. Anat. Entwgesch. Veit, Leipzig

-
- Platzer W (1994) Pernkopf Anatomie. Urban & Schwarzenberg, München Wien Baltimore
- Poirier P, Charpy A (1900–1912) *Traité d'anatomie humaine*. Masson, Paris
- Rauber-Kopsch (1987) *Anatomie des Menschen*. Thieme, Stuttgart New York
- Rosthorn A v (1887) Die Synovialsäcke und Sehnenscheiden der Hohlhand. *Langenbecks Arch. Chir.* 34
- Sorgius (1880) Über die Lymphgefäße der weiblichen Brustdrüse. Diss. Straßburg
- Schliack H (1957) Über Segmentinnervation, Headsche Zonen und Metamerie. *Nervenarzt* 28, Berlin
- Schmidt RM, Garamverian (1965) Die krankhafte Schlingelung der Carotisarterien und ihre chirurgische Behandlung. *Psych. Neurol. med. Psychologie* 17. Hierzel, Leipzig
- Schwalbe G (1881) *Lehrbuch der Neurologie*. Besold, Erlangen
- Siewert JR (1998) *Chirurgie*. Springer, Berlin Heidelberg, New York
- Sobotta (1988) *Atlas der Anatomie des Menschen*. 19. Aufl. Urban & Schwarzenberg, München Wien Baltimore
- Stark D (1965) *Embryologie*. Thieme, Stuttgart
- Stopford JSB (1918) The variations in distribution of the cutaneous nerves of the hand and digits. *J. Anat.*
- Taguchi K (1889) Die Lage des Nervus recurrens nervi vagi zur Arteria thyroidea inferior. *Arch. f. Anat.* 15
- Tandler J (1913) *Anatomie des Herzens*. In: *Handbuch der Anatomie des Menschen von Bardeleben*. Fischer, Jena
- Teutleben E v (1977) Die Ligamenta suspensoria diaphragmatis. *Arch. Anat. u. Physiol., Anat. Abt.* Bd 3
- Testut L (1884) *Traité d'anatomie humaine*. Doin, Paris
- Told (1957) *Anatomischer Atlas*. 23. Aufl. Urban & Schwarzenberg, München Berlin Wien
- Welcker H (1878) Die Einwanderung der Bicepssehne in das Schultergelenk. Nebst Notizen über Lig. interarticulare humeri und Lig. teres femoris. *Arch. f. Anat. Entwgesch.* 20
- Zenker R, Heberer G, Löhr HH (1954) *Die Lungenresektionen. Anatomie-Indikation-Technik*. Springer, Berlin Göttingen Heidelberg
- Zenker W (1955) Über einige Befunde am M. temporalis des Menschen. *Zeitschr. Anat. Entwgesch.* Bd 118
- Zenker W (1955) Das Spatium buccotemporale und die anderen Fascienräume der tiefen seitlichen Gesichtsregion. *Zeitschr. Anat. Entwgesch.* Bd 118
- Zenker W (1956) Das retroarticuläre plastische Polster des Kiefergelenks. *Zeitschr. Anat. Entwgesch.* Bd 119

Proper Names Used in the Text

- ASCHOFF, Ludwig (born 1866). Professor of pathology in Freiburg
- BARTHOLIN, Caspar (1655–1738). Professor of philosophy, later professor of medicine in Copenhagen
- BICHAT, Marie Francois Xavier (1771–1802). Physiologist and pathologic anatomist in Paris
- BOTALLO, Leonardo (ca. 1530–ca. 1600). French military surgeon and personal physician to Kings Charles IX. and Henry III. A pupil of FALLOPPIO in Pavia
- CIVININI, Filippo (died 1844). Professor of surgery, pathology, and anatomy in Pistoia
- COOPER, Sir Astley Paston (1768–1841). Professor of anatomy and surgery at Guy's and St. Thomas' Hospital in London
- DUPUYTREN, Baron Guillaume D. (1777–1835). Paris surgeon
- FLACK, Martin F. (1882–1931). London physiologist. Director of aviator studies during World War I
- GERDY, Pierre Nicholas (1797–1856). Professor of surgery in Paris
- HEAD, Sir Henry (born 1861). London neurologist and lecturer
- HENKE, Wilhelm (1834–1896). Professor of anatomy at Rostock, Prague and Tübingen
- HYRTL, Jozsef (1810–1894). Professor of anatomy at Prague and Vienna
- KEITH, Sir Arthur (born 1866). English physiologist and anthropologist. Chancellor of Aberdeen University, 1930–1933
- LANGER, Karl Ritter von Edenburg (1819–1887). Professor of anatomy in Vienna
- LUDOWICI, Antoine-Louis (1723–1792). Paris surgeon
- MEIBOM, Heinrich (1638–1700). Professor of medicine, history, and poetry at University of Helmstädt
- MOHRENHEIM, Joseph Jakob (died 1899). Surgeon, obstetrician, and ophthalmologist in Vienna, professor of medicine and college lecturer in St. Petersburg
- MORGAGNI, Giovanni Battista (1682–1771). Professor of anatomy in Padua
- PACINI, Filippo (1812–1883). Professor of anatomy in Florence
- SAPPEY, Marie Philibert Constant (1810–1896). Professor of anatomy in Paris
- SCARPA, Antonio (1747–1832). Professor of anatomy and surgeon in Modena and Pavia. Surgeon to Napoleon I.
- STENSEN, Niels (1638–1686). Professor of anatomy and later priest-physician in Copenhagen
- TAWARA, Sunao (born 1875). Professor of pathology at University of Fukuoka until 1912. Conducted scientific research at Aschoff Institute in Marburg (1903–1906)

TENON, Jacques-René (1724–1826). Surgeon at the Sàpêtrière and professor of pathology in Paris

THEBESIUS, Adam Christian (1686–1732). Physician in Hirschberg (Silasia). Dissertation at the University of Leyden

VALSALVA, Antonio Maria (1666–1723). Professor of anatomy in Bologna

VATER, Abraham (1684–1751). Professor of anatomy and botany in Wittenberg

WHARTON, Thomas (1614–1673). London physician

Neck
Carotid Triangle
Thyroid Gland
Head
Salivary Glands
Temporal Region and Orbit

Suboccipital Puncture
Back
Lumbar Puncture

Thorax and Breast
Breast Contents
Axillary Cavity

Upper Arm
Elbow
Forearm
Hand

Shoulder Joint
Elbow Joint
Joints of the Hand

Figure 1 **Superficial Cervical Region 1**
Punctum nervosum

- | | |
|---|---|
| 1 Subcutaneous tissue (with copious fat) | 17 Superficial cervical fascia (cut edge) |
| 2 Parotid fascia | 18 Sternocleidomastoid muscle |
| 3 Junction of parotid fascia | (covered by superficial cervical fascia) |
| with firm deep layer of stratum subcutaneum | 19 Superficial cervical fascia |
| 4 Transverse cervical nerve | (thickened by fusion with deep layer |
| 5 Auricularis magnus nerve (anterior branch) | of stratum subcutaneum from deep surface |
| 6 Auricularis magnus nerve (posterior branch) | of platysma) |
| 7 Auricularis magnus nerve (trunk) | 20 Sternoclavicular joint |
| 8 Punctum nervosum | 21 Jugular fossa |
| 9 External jugular vein | 22 Residual bridge of deep layer |
| 10 Fat pad in posterior cervical triangle | of stratum subcutaneum |
| with branch of transversa cervicalis artery | from deep surface of platysma |
| 11 Medial supraclavicular nerve | 23 Subcutaneous tissue (devoid of fat) |
| (suprasternal nerve) | 24 Deep layer of stratum subcutaneum |
| 12 Platysma | from outer surface of platysma |
| 13 Sternocleidomastoid muscle | 25 Facial nerve (cervical branch) |
| (covered by superficial cervical fascia) | 26 Platysma (cut edge) |
| 14 Branch of suprascapular artery | 27 Continuation of parotid fascia |
| (suprasternal branch) | into deep layer of stratum subcutaneum |
| 15 Clavicle | at outer surface of platysma |
| 16 Attachment of superficial cervical fascia | 28 Continuation of parotid fascia |
| (superficial layer of cervical fascia) | into deep layer of stratum subcutaneum |
| to deep layer of stratum subcutaneum | at deep surface of platysma |

1 2 3 4

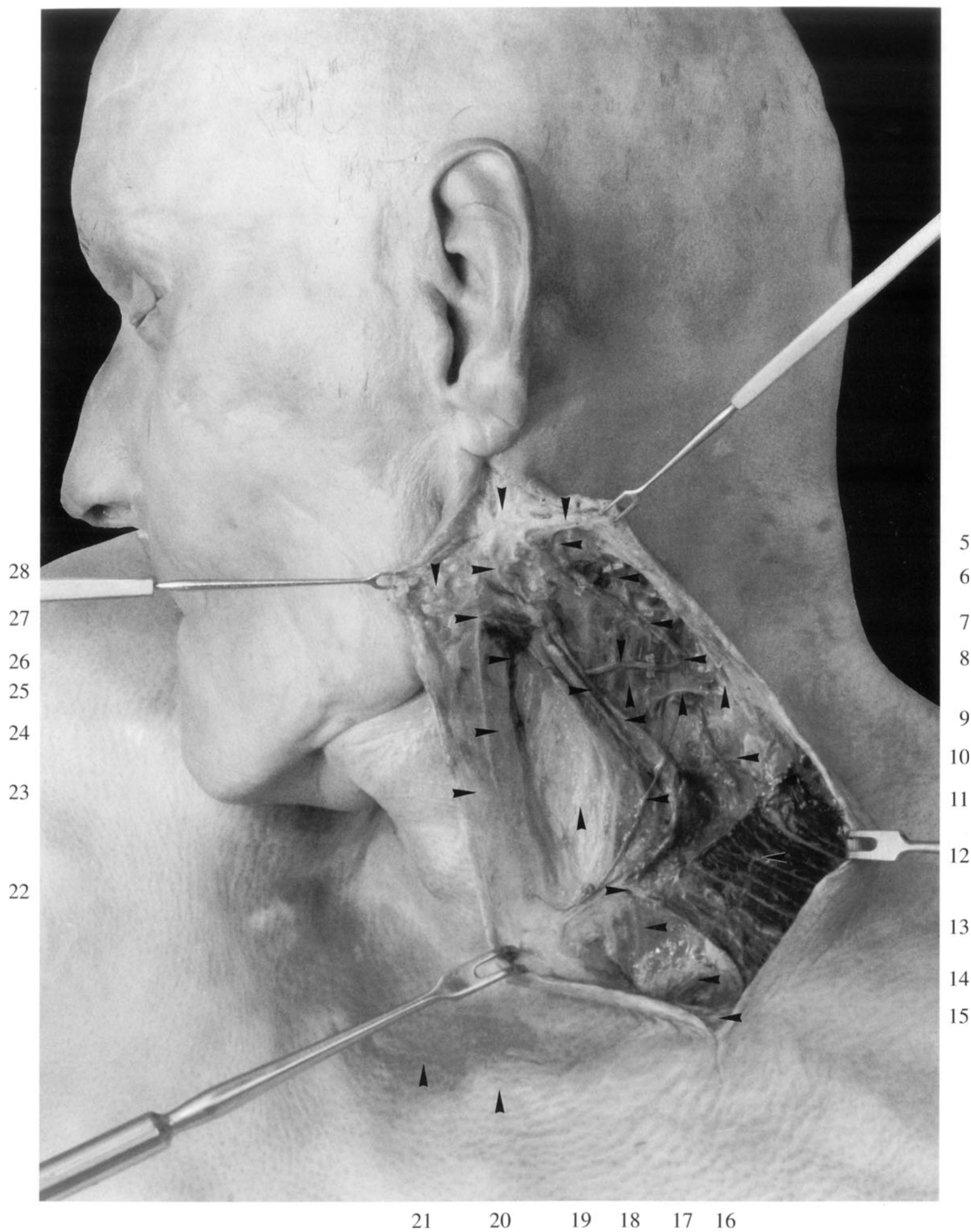


Figure 2

Median Cervical Region 1

- | | |
|---|--|
| 1 Parotid-masseter region | 15 Platysma |
| 2 Position of mandibular angle | 16 Greater supraclavicular fossa |
| 3 Cheek | 17 Bulge of clavicle |
| 4 Position of inferior border of mandible | 18 Platysma (aberrant muscle bundle) |
| 5 Lower lip | 19 Manubrium sterni |
| 6 Angle of mouth | 20 Prominence of sternal end of clavicle |
| 7 Cheek | 21 Jugular fossa |
| 8 Parotid-masseter region | 22 Position of posterior border
of sternocleidomastoid muscle |
| 9 Earlobe | 23 Platysma |
| 10 Chin | 24 Subcutaneous tissue |
| 11 Position of hyoid bone | 25 Skin (cut edge) |
| 12 Bulge of sternocleidomastoid muscle | 26 Bulge of sternocleidomastoid muscle |
| 13 Linea alba of neck,
visible through superficial cervical fascia | 27 Earlobe |
| 14 Medial border of sternohyoid muscle
behind fascial layers | 28 Antitragus |

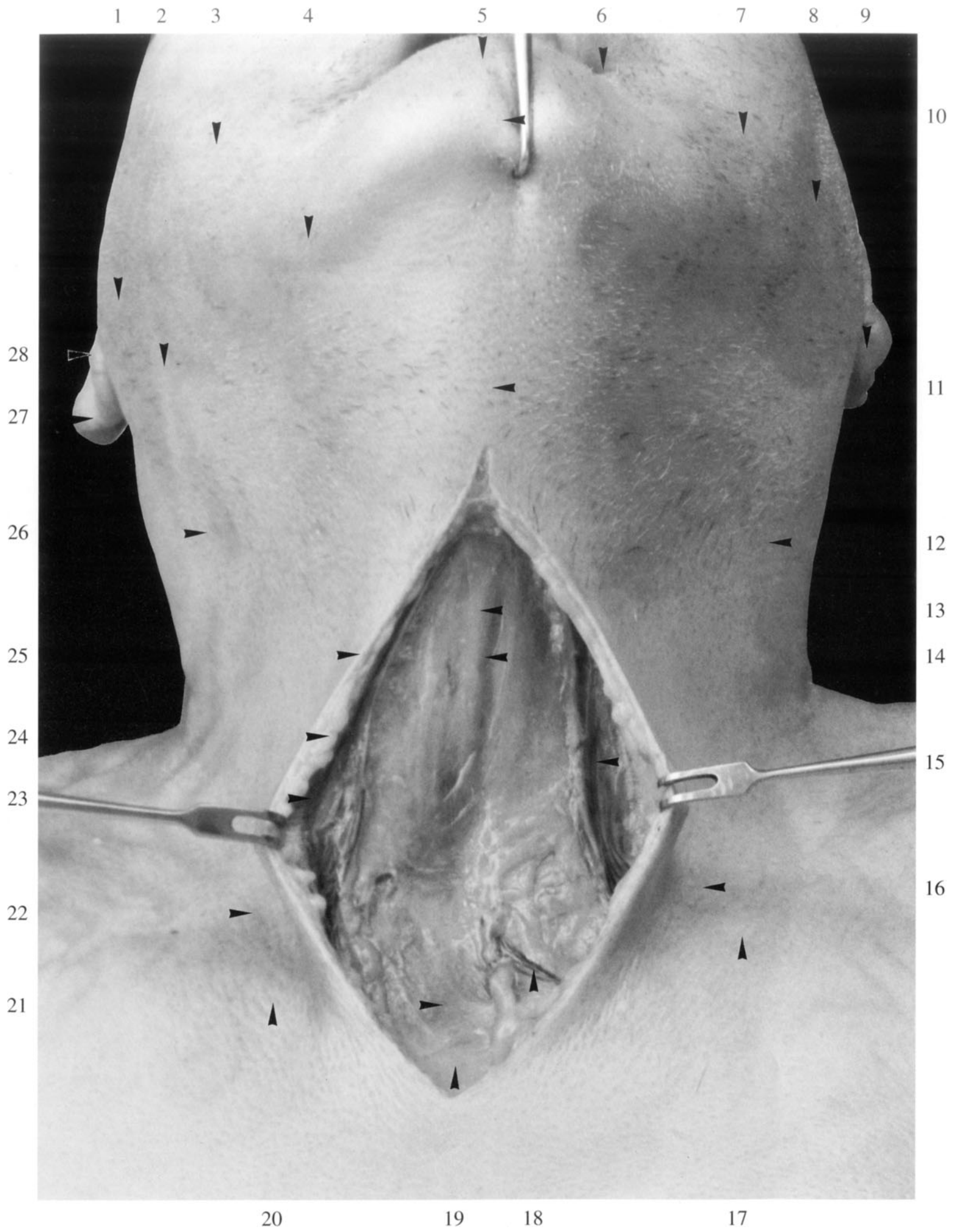


Figure 3

Median Cervical Region 2

- | | | | |
|----|--|----|--|
| 1 | Position of mandibular angle | 14 | Bulge of clavicle |
| 2 | Position of inferior border of mandible | 15 | Sternoclavicular joint |
| 3 | Chin | 16 | Jugular notch of sternum |
| 4 | Submental triangle | 17 | Bulge of clavicle |
| 5 | Position of hyoid bone | 18 | Tendon of sternocleidomastoid muscle |
| 6 | Subcutaneous tissue | 19 | Residual connective tissue in suprasternal space |
| 7 | Slit in superficial cervical fascia | 20 | Anterior jugular vein |
| 8 | Medial border of left sternohyoid muscle
(visible through fascia) | 21 | Superficial cervical fascia (cut edge) |
| 9 | Superficial cervical fascia (cut edge) | 22 | Platysma |
| 10 | Platysma | 23 | Slit in superficial cervical fascia |
| 11 | Anterior jugular vein | 24 | Skin (cut edge) |
| 12 | Jugular arch | 25 | Bulge of sternocleidomastoid muscle |
| 13 | Tendon of sternocleidomastoid muscle | 26 | Bulge from cervical lobe of parotid gland |

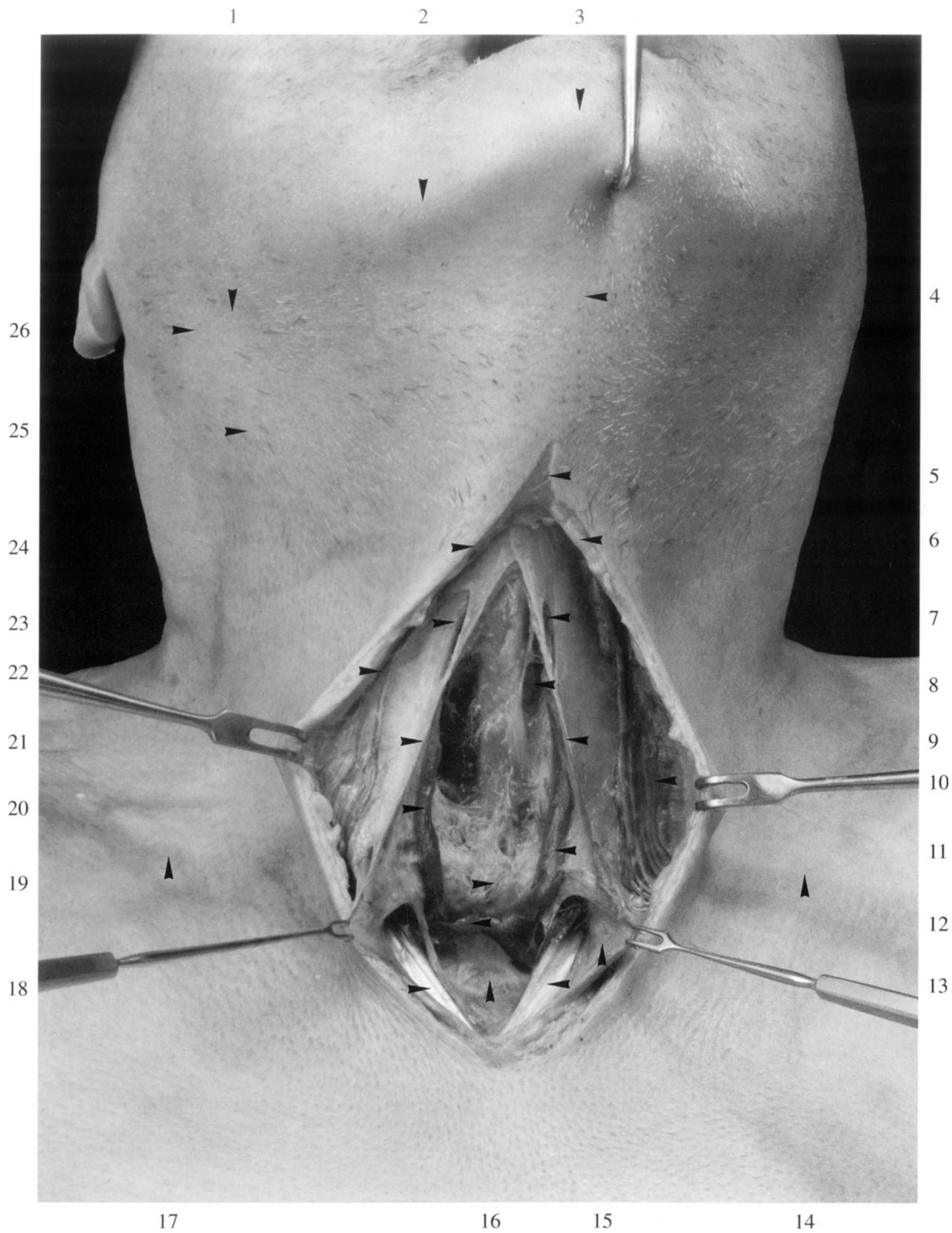


Figure 4

Median Cervical Region 3

- | | | | |
|---|---|----|--|
| 1 | Thickened part of middle cervical fascia
(pretracheal layer of cervical fascia)
between two tendinous intersections | 10 | Jugular arch (resected) |
| 2 | Tendinous intersection of sternohyoid muscle
(incomplete) | 11 | Inferior thyroid vein |
| 3 | Superficial cervical fascia (cut edge) | 12 | Thyroid ima artery |
| 4 | Sternohyoid muscle (covered by fascia) | 13 | Jugular arch (resected) |
| 5 | Linea alba of middle cervical fascia
(at level of conus elasticus) | 14 | Jugular notch of sternum |
| 6 | Anterior jugular vein | 15 | Sternothyroid muscle (covered by fascia) |
| 7 | Middle cervical fascia (cut edge) | 16 | Isthmus of thyroid gland |
| 8 | Sternothyroid muscle (covered by fascia) | 17 | Anterior jugular vein |
| 9 | Trachea | 18 | Intersection of sternohyoid muscle |
| | | 19 | Sternohyoid muscle (covered by fascia) |
| | | 20 | Superficial cervical fascia (cut edge) |
| | | 21 | Bulge of sternocleidomastoid muscle |
| | | 22 | Hyoid bone |

1

2

22

21

20

19

18

17

16

15

14

3

4

5

6

7

8

9

13

12

11

10

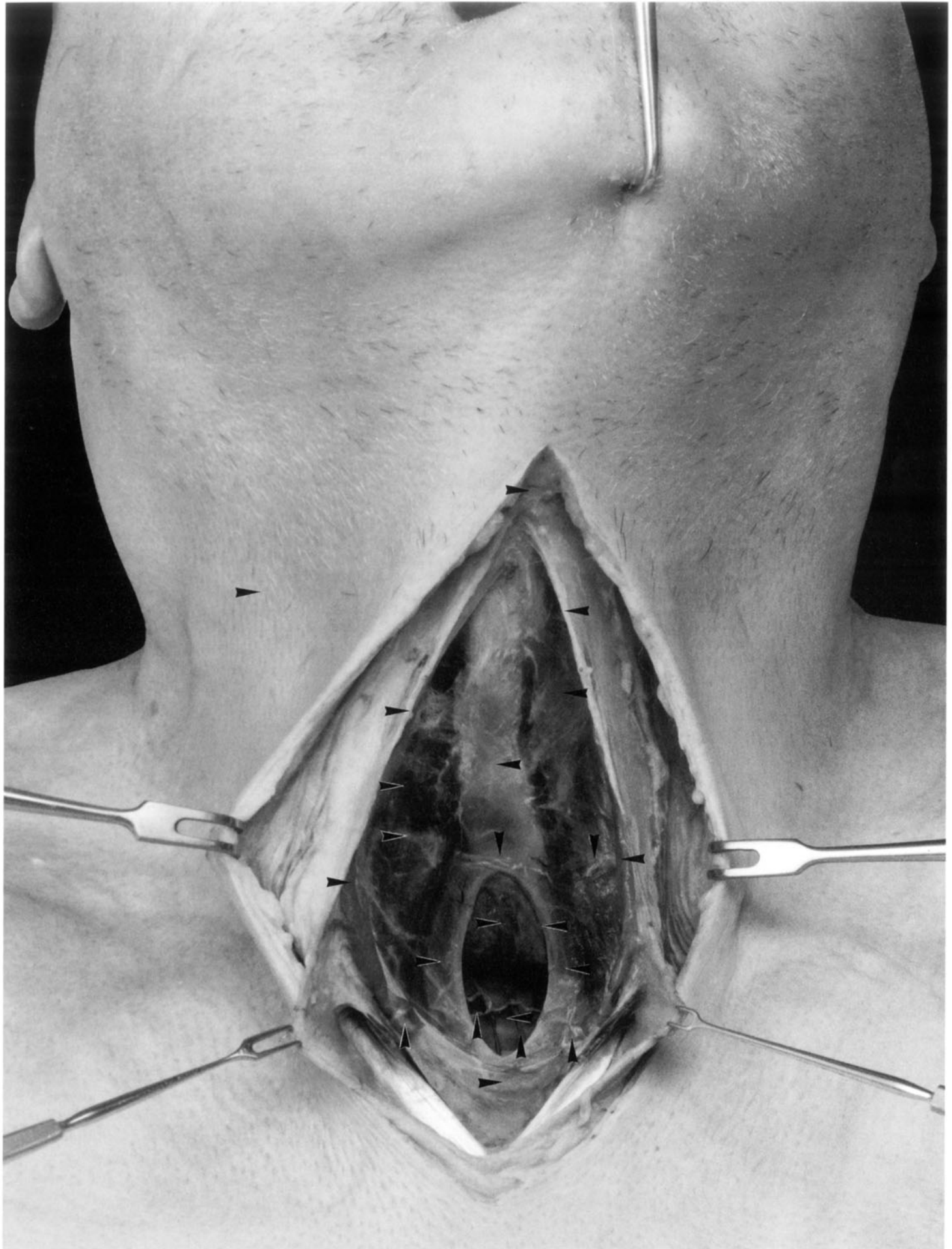


Figure 5

Median Cervical Region 4

- | | | | |
|----|---|----|--|
| 1 | Cricothyroid muscle | 15 | Trachea |
| 2 | Conus elasticus | 16 | Sternothyroid muscle (covered by fascia) |
| 3 | Cricothyroid branch with vein | 17 | Tendon of sternocleidomastoid muscle |
| 4 | Hyoid bone | 18 | Jugular notch of sternum |
| 5 | Superior thyroid notch | 19 | Thyroid ima artery |
| 6 | Middle cervical fascia
(pretracheal layer of cervical fascia) (cut edge) | 20 | Middle cervical fascia (cut edge) |
| 7 | Sternothyroid muscle (covered by fascia) | 21 | Anterior jugular vein |
| 8 | Superior thyroid artery | 22 | Thyroid gland isthmus |
| 9 | Anterior jugular vein | 23 | Sternohyoid muscle
(with two tendinous intersections) |
| 10 | Superficial cervical fascia (cut edge) | 24 | Arch of cricoid cartilage |
| 11 | Middle cervical fascia (cut edge) | 25 | Superficial cervical fascia (cut edge) |
| 12 | Inferior thyroid vein | 26 | Right lamina of thyroid cartilage |
| 13 | Tendon of sternocleidomastoid muscle | 27 | Superficial cervical fascia (cut edge) |
| 14 | Sternothyroid muscle (covered by fascia) | | |

1 2 3

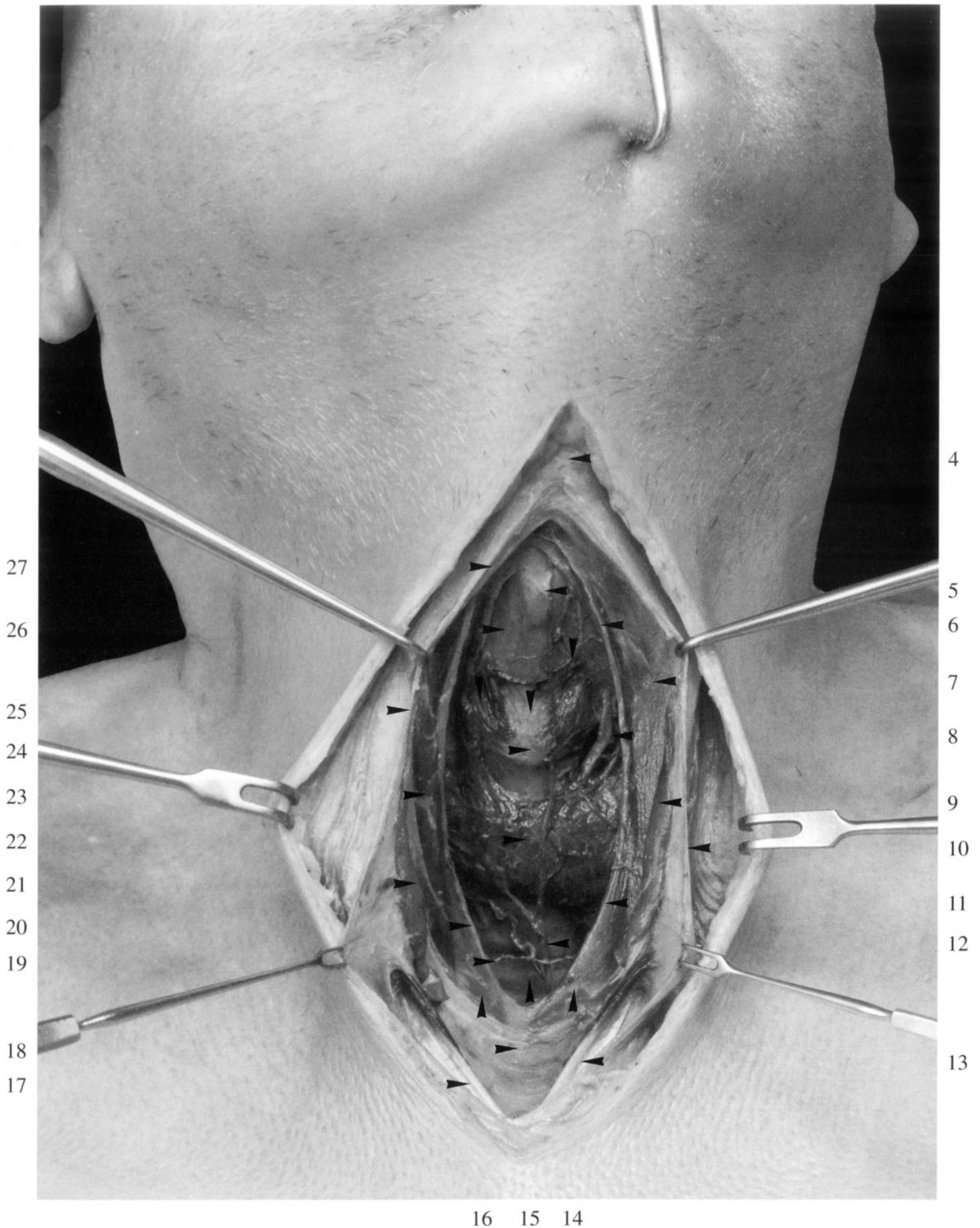


Figure 6

Median Cervical Region 5

- | | | | |
|----|---|----|--|
| 1 | Sternohyoid muscle | 16 | Sternothyroid muscle |
| 2 | Conus elasticus | | (with fascia and tendinous intersection) |
| 3 | Cricothyroid branch with vein | 17 | Trachea |
| 4 | Sternohyoid muscle | 18 | Sternothyroid muscle (with fascial covering) |
| 5 | Body of hyoid bone | 19 | Tendinous intersection of sternohyoid muscle |
| 6 | Accessory thyroid gland | 20 | Jugular notch of sternum |
| 7 | Median thyroid ligament | 21 | Sternocleidomastoid muscle |
| 8 | Laryngeal prominence | | (medial musculotendinous junction) |
| 9 | Cricothyroid muscle | 22 | Thyroid ima artery |
| 10 | Superior thyroid artery | 23 | Thyroid gland isthmus |
| 11 | Superficial cervical fascia | 24 | Sternocleidomastoid muscle |
| 12 | Communicating vein between inferior
and superior thyroid veins | 25 | Trachea with first tracheal cartilage |
| 13 | Sternocleidomastoid muscle | 26 | Arch of cricoid cartilage |
| 14 | Inferior thyroid vein | 27 | Superficial cervical fascia (cut edge) |
| 15 | Tendon of sternocleidomastoid muscle | 28 | Superficial cervical fascia (cut edge) |
| | | 29 | Omohyoid muscle |

1 2 3 4

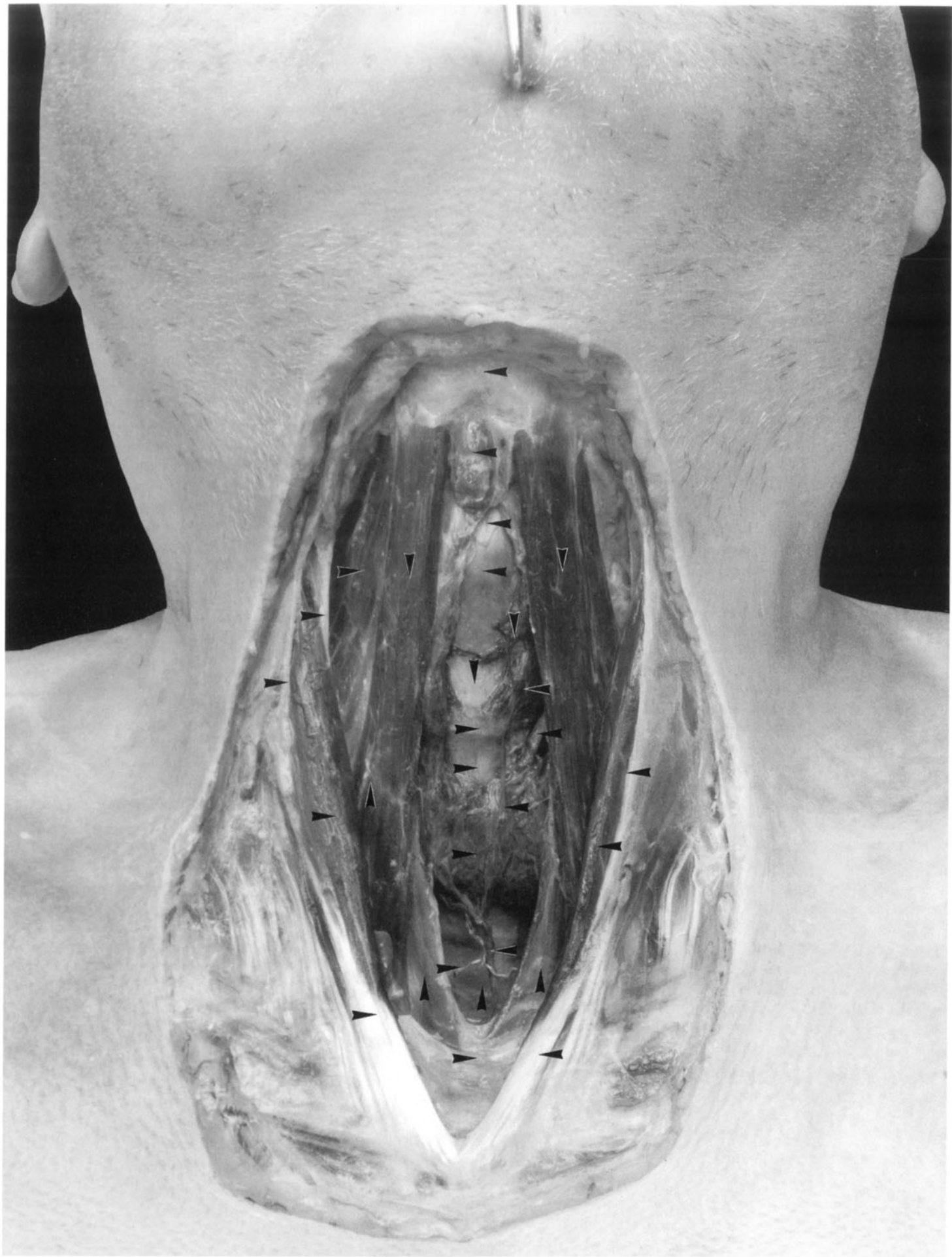
29
28
27
26
25
24
23

22
21
20

5
6
7
8

9
10
11
12
13

14
15



19 18 17 16

Figure 7**Median Cervical Region 6**

- | | | | |
|----|---|----|--|
| 1 | Sternohyoid muscle | 17 | Jugular notch of sternum |
| 2 | Sternothyroid muscle
(applied to right lobe of thyroid gland) | 18 | Sternocleidomastoid muscle |
| 3 | Laryngeal prominence | 19 | Trachea |
| 4 | Cricothyroid branch of superior thyroid artery | 20 | Jugular arch (resected) |
| 5 | Sternohyoid muscle | 21 | Sternocleidomastoid muscle |
| 6 | Accessory thyroid gland | 22 | Anterior jugular vein (resected) |
| 7 | Median thyroid ligament | 23 | Thyroid ima artery |
| 8 | Thyrohyoid muscle | 24 | Sternothyroid muscle (covered by fascia) |
| 9 | Superior thyroid artery | 25 | Thyroid gland isthmus |
| 10 | Cricothyroid muscle | 26 | Cricotracheal ligament |
| 11 | Sternothyroid muscle | 27 | Conus elasticus
with median cricothyroid ligament |
| 12 | Sternothyroid muscle (covered by fascia) | 28 | Inferior thyroid tubercle |
| 13 | Communicating vein between inferior
and superior thyroid veins | 29 | Rudiment of thyroglossal duct
(suspensory ligament of pyramidal lobe)
with embedded accessory thyroid glands |
| 14 | Tendinous intersection of sternothyroid muscle | 30 | Thyrohyoid muscle |
| 15 | Tracheal cartilage | 31 | Thyrohyoid membrane |
| 16 | Inferior thyroid vein | 32 | Body of hyoid bone |

1 2 3 4 5

32

31

30

29

28

27

26

25

24

23

22

6

7

8

9

10

11

12

13

14

15

16

17

21

20

19

18

Figure 8

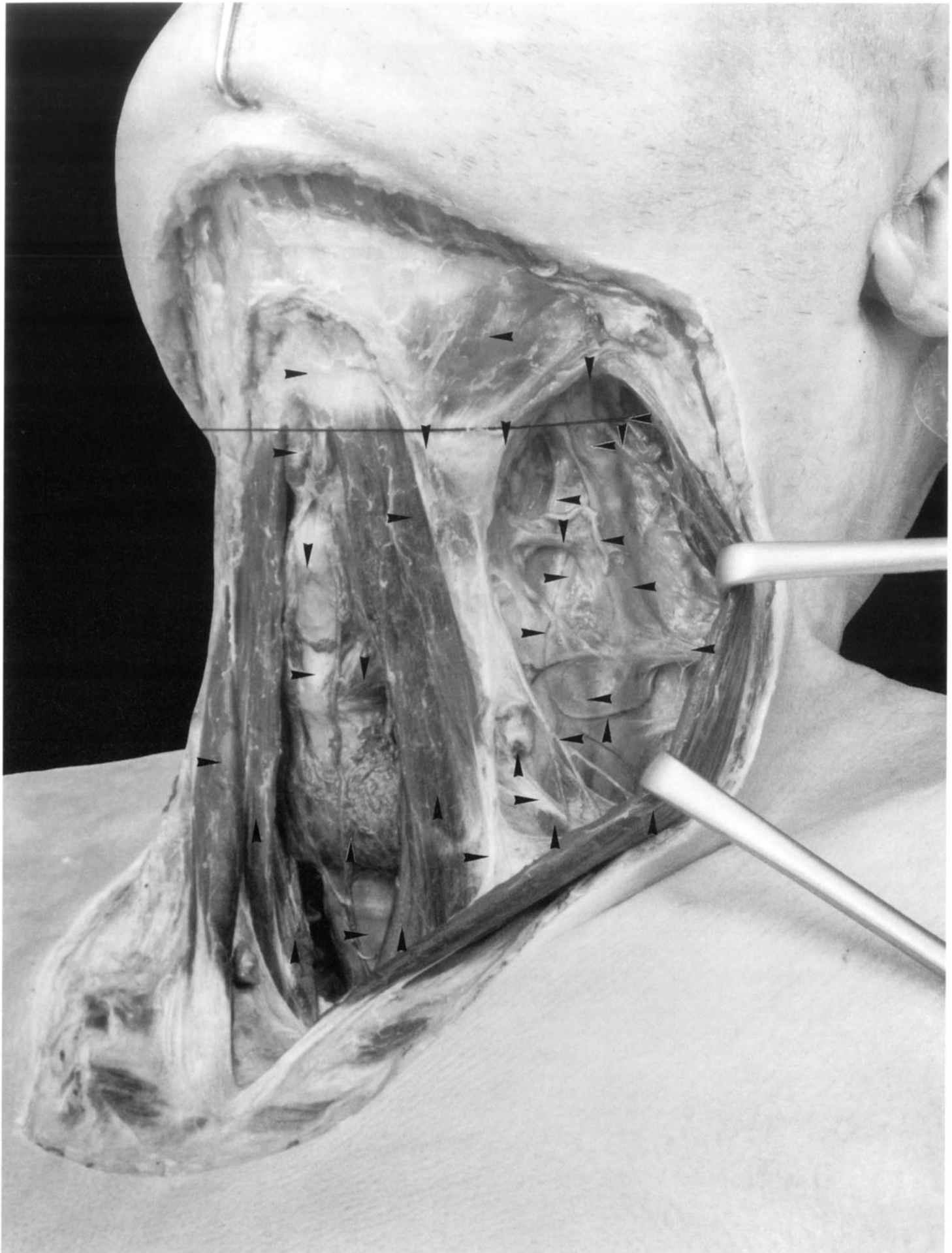
**Median Cervical Region 7
Sternocleidomastoid Region 1
Carotid Triangle 1**

- | | | | |
|----|---|----|--|
| 1 | Laryngeal prominence | 18 | Jugulo-omohyoid node of deep cervical chain,
covered by middle cervical fascia |
| 2 | Cricothyroid muscle | 19 | Deep medial cervical lymph node |
| 3 | Superficial cervical fascia (cut edge) | 20 | Sternohyoid muscle with tendinous intersection |
| 4 | Superficial cervical fascia (cut edge) | 21 | Sternothyroid muscle |
| 5 | Digastric muscle (posterior belly) | 22 | Isthmus of thyroid gland |
| 6 | Sternocleidomastoid branch
of external carotid artery | 23 | Sternothyroid muscle |
| 7 | Submandibular gland,
covered by superficial cervical fascia | 24 | Sternohyoid muscle |
| 8 | Accessory nerve | 25 | Trachea |
| 9 | Jugulodigastric node of deep cervical chain | 26 | Superficial cervical fascia
(cut edge of deep layer
of sternocleidomastoid fascia) |
| 10 | External carotid artery in carotid sheath | 27 | Intermediate tendon of omohyoid muscle |
| 11 | Sternocleidomastoid branch
of superior thyroid artery | 28 | Sternocleidomastoid muscle |
| 12 | Internal jugular vein with adventitia | 29 | Conus elasticus
with median cricothyroid ligament |
| 13 | Sternocleidomastoid vein | 30 | Ansa cervicalis (anterior root)
(descending branch of hypoglossal nerve) |
| 14 | Thyroid gland in its fibrous capsule
(lateral border of left lobe) | 31 | Common carotid artery with carotid bifurcation |
| 15 | Sternocleidomastoid branch
of superior thyroid artery | 32 | Omohyoid muscle (superior belly) |
| 16 | Sternocleidomastoid muscle | 33 | Accessory thyroid gland |
| 17 | Ansa cervicalis | 34 | Body of hyoid bone |

1 2 3 4 5 6

34
33
32
31
30
29
28
27
26
25

7
8
9
10
11
12
13
14
15



24 23 22 21 20 19 18 17 16

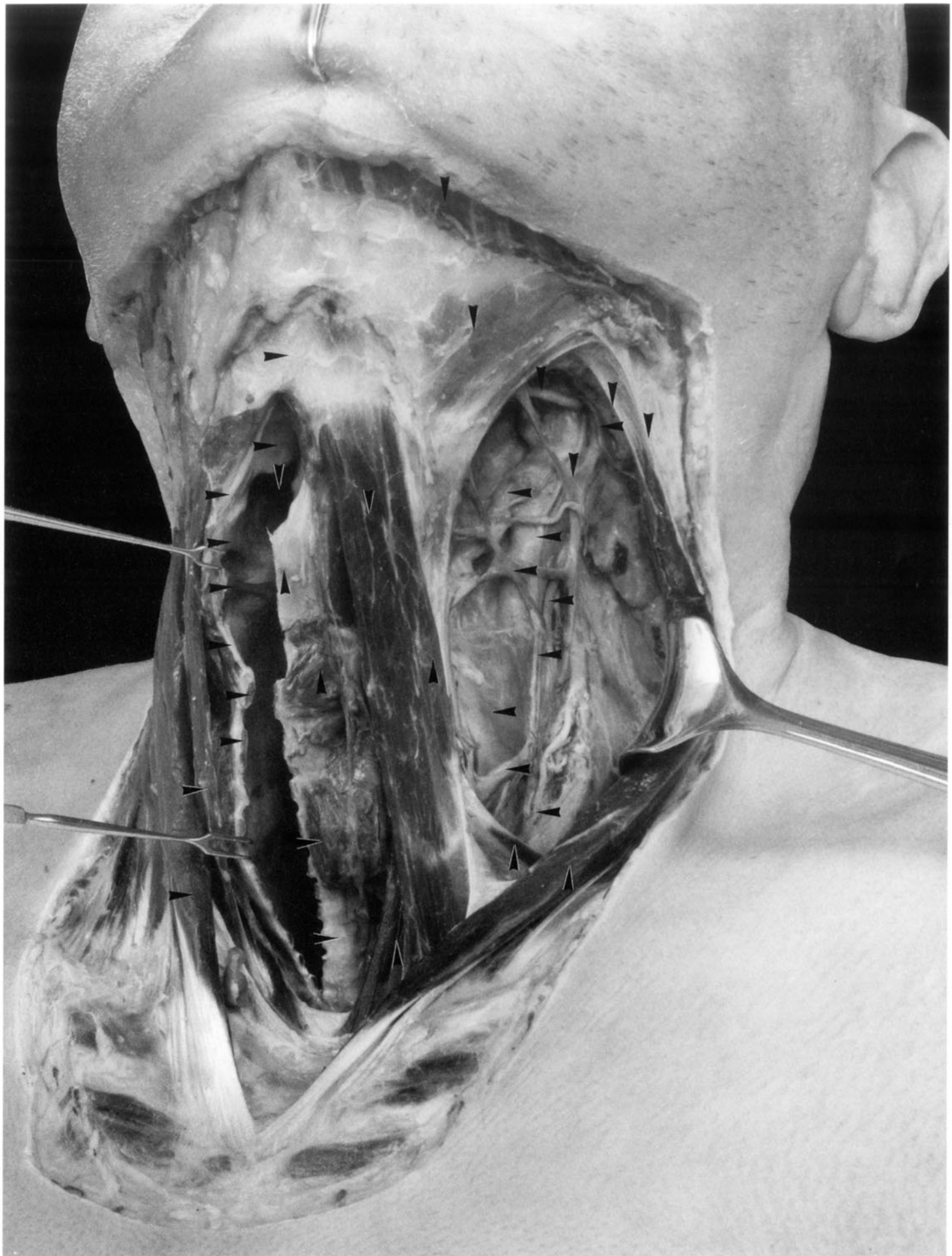
Figure 9**Median Cervical Region 8
Sternocleidomastoid Region 2
Carotid Triangle 2**

- | | | | |
|----|---|----|--|
| 1 | Aperture of larynx | 17 | Ascending cervical artery |
| 2 | Sternohyoid muscle | 18 | Sternocleidomastoid muscle |
| 3 | Platysma | 19 | Omohyoid muscle (inferior belly) |
| 4 | Submandibular gland (in its compartment) | 20 | Omohyoid muscle (superior belly) |
| 5 | Hypoglossal nerve | 21 | Sternothyroid muscle |
| 6 | Internal jugular vein with facial vein | 22 | Cricothyroid muscle |
| 7 | Superficial cervical fascia
(medial layer for sternocleidomastoid muscle) | 23 | Thyroid cartilage (left lamina) |
| 8 | Superficial cervical fascia
(lateral layer for sternocleidomastoid muscle) | 24 | Trachea |
| 9 | Sternocleidomastoid artery | 25 | Sternocleidomastoid muscle |
| 10 | Superior thyroid artery | 26 | Thyroid gland isthmus (cut surface) |
| 11 | Carotid bifurcation | 27 | Sternohyoid muscle |
| 12 | Thyrolingual trunk
(formed by superior thyroid vein
and lingual vein) | 28 | Thyroid cartilage (cut surface) |
| 13 | Vagus nerve | 29 | Arch of cricoid cartilage (cut surface) |
| 14 | Ansa cervicalis (anterior root)
(descending branch of hypoglossal nerve) | 30 | Conus elasticus (cut surface) |
| 15 | Thyroid gland (left lobe in its fibrous capsule) | 31 | Vocal fold |
| 16 | Middle thyroid vein | 32 | Vestibular (ventricular) fold |
| | | 33 | Thyrohyoid membrane
with median thyrohyoid ligament |
| | | 34 | Epiglottis |
| | | 35 | Body of hyoid bone |

1 2 3 4 5 6 7 8

35
34
33
32
31
30
29
28
27
26
25
24

9
10
11
12
13
14
15
16
17



23 22 21 20 19 18

Figure 10

Carotid Triangle 3
Exposure of Common Carotid Artery 1

- | | | | |
|----|---|----|---|
| 1 | Mandibular angle (gonion) | 12 | Transverse cervical nerve (superior branch) |
| 2 | Parotid fascia | 13 | Fascia-like connective tissue layer
on deep surface of platysma
(blending with superficial cervical fascia) |
| 3 | Fat pad between dense connective tissue
on deep surface of platysma
and superficial cervical fascia | 14 | Bulge of clavicle |
| 4 | Mastoid process | 15 | Sternoclavicular joint |
| 5 | Subcutaneous tissue (superficial to platysma) | 16 | Superficial cervical lymph node |
| 6 | Platysma | 17 | Fascia-like connective tissue layer
on outer surface of platysma |
| 7 | Fascia-like connective tissue layer
on deep surface of platysma | 18 | Omohyoid muscle (superior belly,
covered by superficial cervical fascia) |
| 8 | Superficial cervical fascia | 19 | Platysma |
| 9 | Fascia-like connective tissue layer
on deep surface of platysma | 20 | Subcutaneous tissue (superficial to platysma) |
| 10 | Fascia-like connective tissue layer
on outer surface of platysma | 21 | Fascia-like connective tissue layer
on deep surface of platysma |
| 11 | Sternocleidomastoid muscle
(covered by superficial cervical fascia) | 22 | Cervical branch of facial nerve |

1 2 3 4

22
21
20
19
18
17
16

5
6
7
8
9
10
11
12
13
14
15

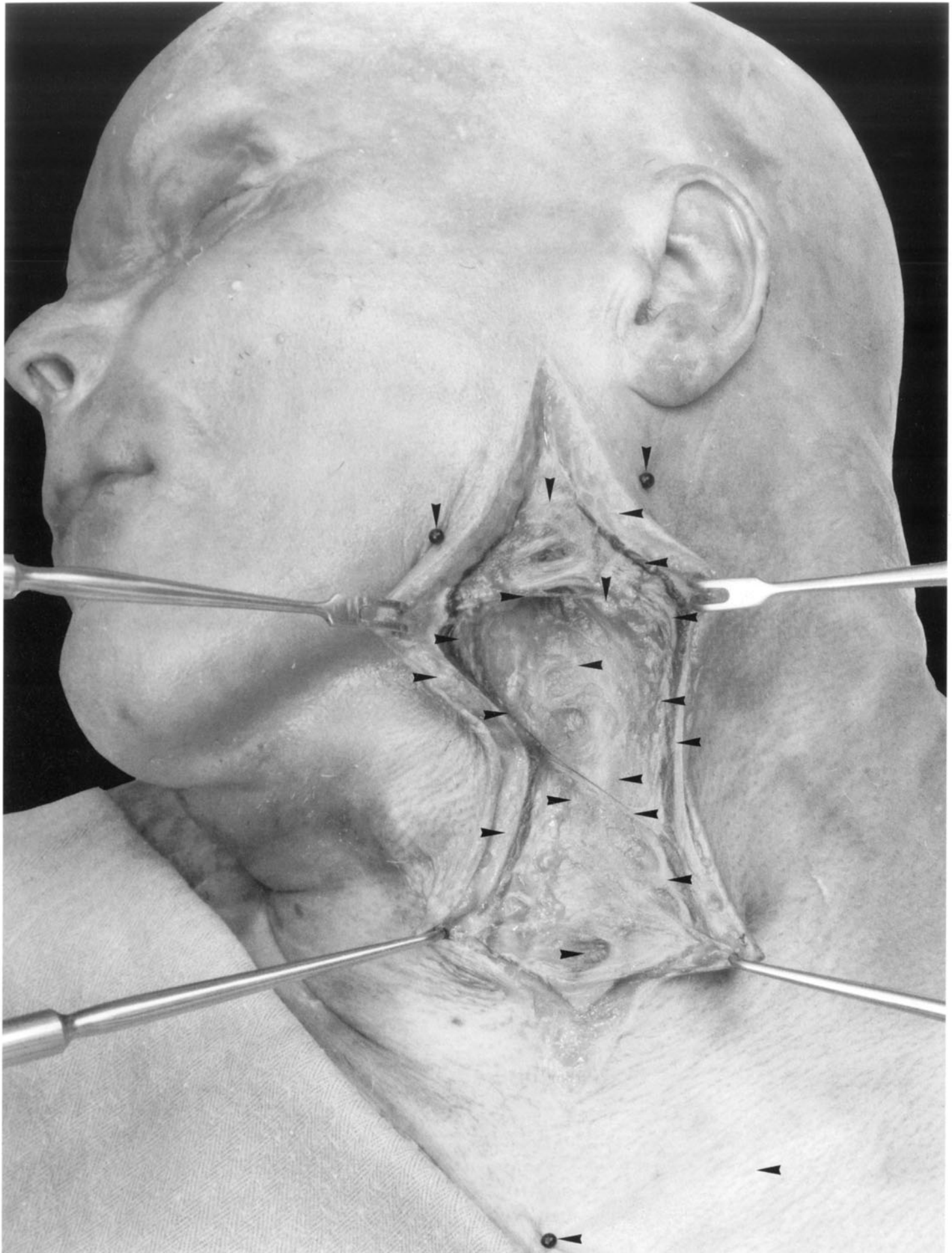


Figure 11

Carotid Triangle 4
Exposure of Common Carotid Artery 2

- | | | | |
|----|--|----|--|
| 1 | Digastric muscle (intermediate tendon) | 13 | Omohyoid muscle (superior belly),
covered by fascia |
| 2 | Superficial cervical fascia | 14 | Deep cervical lymph node (lateral) |
| 3 | Cervical branch of facial nerve | 15 | Thyrolinguofacial trunk formed
by union of thyroid, lingual, and facial veins |
| 4 | Retromandibular vein | 16 | Deep cervical lymph node (medial) |
| 5 | Superficial cervical lymph node | 17 | Facial vein |
| 6 | External jugular vein | 18 | Superficial cervical fascia (cut edge) |
| 7 | Parotid gland (cervical lobe) | 19 | Superior thyroid vein |
| 8 | Platysma with fascia-like condensation
of connective tissue on its deep surface | 20 | Superior thyroid artery |
| 9 | Jugulodigastric node | 21 | Hypoglossal nerve |
| 10 | Internal jugular vein | 22 | Deep cervical lymph nodes (medial) |
| 11 | Common carotid artery with anterior root
of ansa cervicalis in the carotid sheath | 23 | Platysma (cut edge) |
| 12 | Sternocleidomastoid muscle, covered by fascia | 24 | Subcutaneous tissue |
| | | 25 | Parotid fascia |

1 2 3 4 5 6

25

24

23

22

21

20

19

18

7

8

9

10

11

12

13

17

16

15

14

Figure 12

Carotid Triangle 5
Exposure of Common Carotid Artery 3

- | | | | |
|----|--|----|--|
| 1 | Platysma | 16 | Middle cervical fascia |
| 2 | Facial nerve (cervical branch) | | (pretracheal layer of cervical fascia) |
| 3 | Lingual vein | 17 | Sternocleidomastoid muscle |
| 4 | Hypoglossal nerve | 18 | Common carotid artery |
| 5 | Superficial cervical fascia (cut edge) | 19 | Superior thyroid artery |
| 6 | Jugulodigastric node | 20 | Sternohyoid muscle in middle cervical fascia |
| 7 | Infraauricular lymph node | 21 | Facial vein |
| 8 | Superficial cervical lymph node | 22 | Superficial cervical fascia |
| 9 | External jugular vein | 23 | Deep cervical lymph node (medial) |
| 10 | Internal jugular vein | 24 | Superior thyroid artery and vein |
| 11 | Carotid sheath (cut edge) | 25 | Carotid sheath (cut edge) |
| 12 | Vagus nerve | 26 | Superior laryngeal artery |
| 13 | Ansa cervicalis (anterior root) | 27 | Thyrolinguofacial trunk |
| | (descending branch of hypoglossal nerve) | 28 | Digastric muscle (posterior belly) |
| 14 | Thyroid gland (left lobe, superior pole) | 29 | Infraauricular lymph node |
| 15 | Omohyoid muscle (superior belly) | 30 | Parotid gland (cervical lobe) |

1 2 3 4 5 6 7

30
29
28
27
26
25
24
23
22

8
9
10
11
12
13
14
15
16

21 20 19 18 17

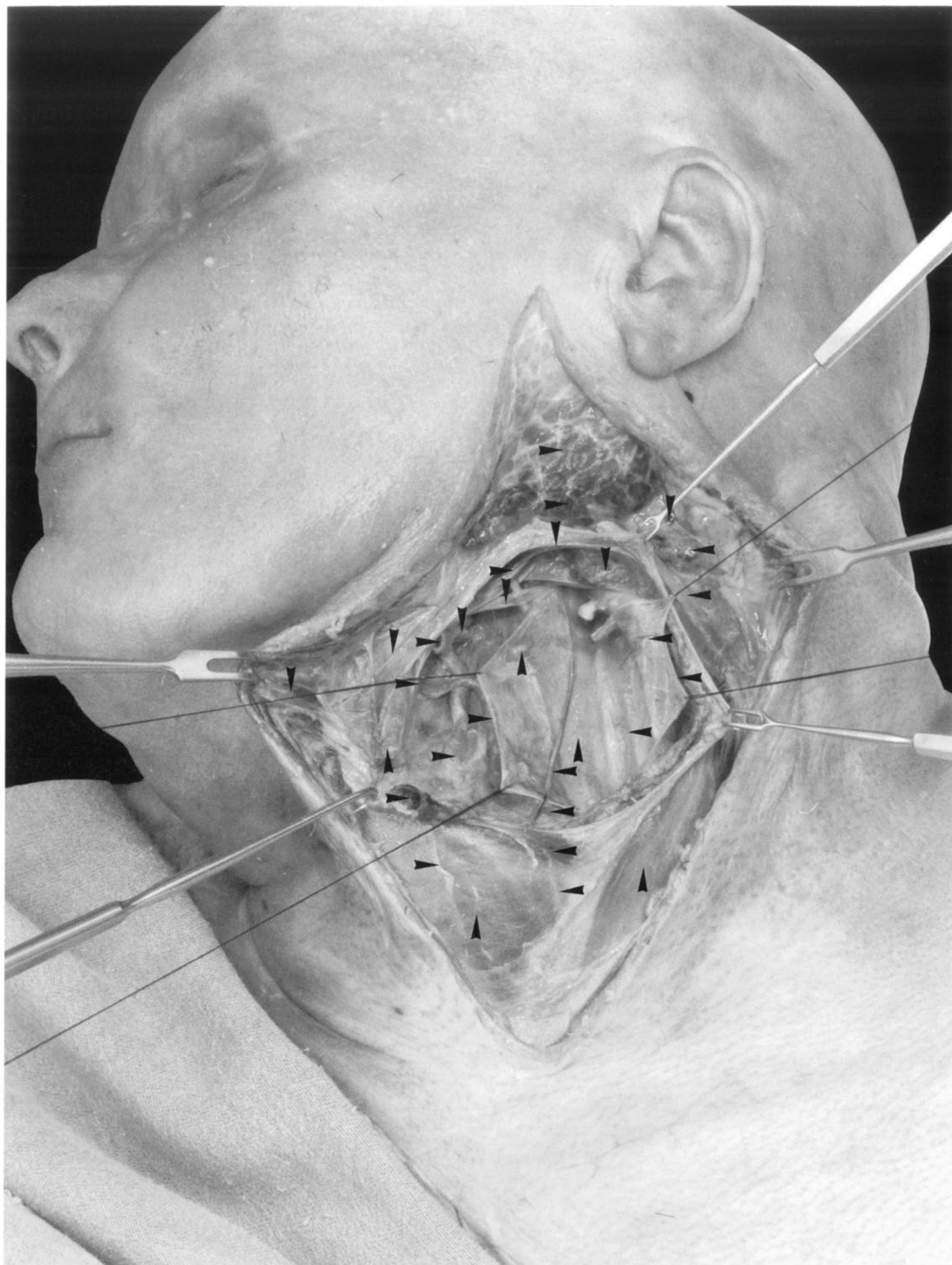


Figure 13

**Carotid Triangle 6
External Carotid Artery**

- | | |
|--|--|
| 1 Thyrolinguofacial trunk | 18 Internal jugular vein |
| 2 Platysma (cut edge) | with resected venous terminations |
| 3 Hypoglossal nerve with lingual vein | 19 Sternocleidomastoid artery |
| 4 Stylohyoid muscle | 20 Common carotid artery and carotid bifurcation |
| 5 Digastric muscle (posterior belly) | 21 Superior thyroid artery |
| 6 Internal jugular vein | 22 Deep layer of stratum subcutaneum |
| 7 Retromandibular vein | (fascial connective-tissue condensation |
| 8 Deep layer of stratum subcutaneum | on deep surface of platysma) |
| as continuation of parotid fascia | 23 Facial vein (cut surface) |
| 9 Platysma (deep surface) | 24 Superficial cervical fascia (cut edge) |
| 10 Occipital artery | 25 Sternohyoid muscle |
| 11 External carotid artery | (embedded in middle cervical fascia) |
| 12 External jugular vein | 26 Omohyoid muscle (superior belly) |
| 13 Ansa cervicalis (anterior root) | 27 Thyroid gland (left lobe, superior pole) |
| (descending branch of hypoglossal nerve) | 28 Deep cervical lymph node (medial) |
| 14 Vagus nerve | 29 Superior thyroid vein |
| 15 Sternocleidomastoid muscle | 30 Lingual artery |
| 16 Middle cervical fascia | 31 Facial artery |
| (pretracheal layer of cervical fascia) | 32 Superficial cervical fascia (cut edge) |
| in front of left lobe of thyroid gland | 33 External carotid artery |
| 17 Deep cervical lymph node (pulled forward) | 34 Parotid gland (cervical lobe) |

1 2 3 4 5 6

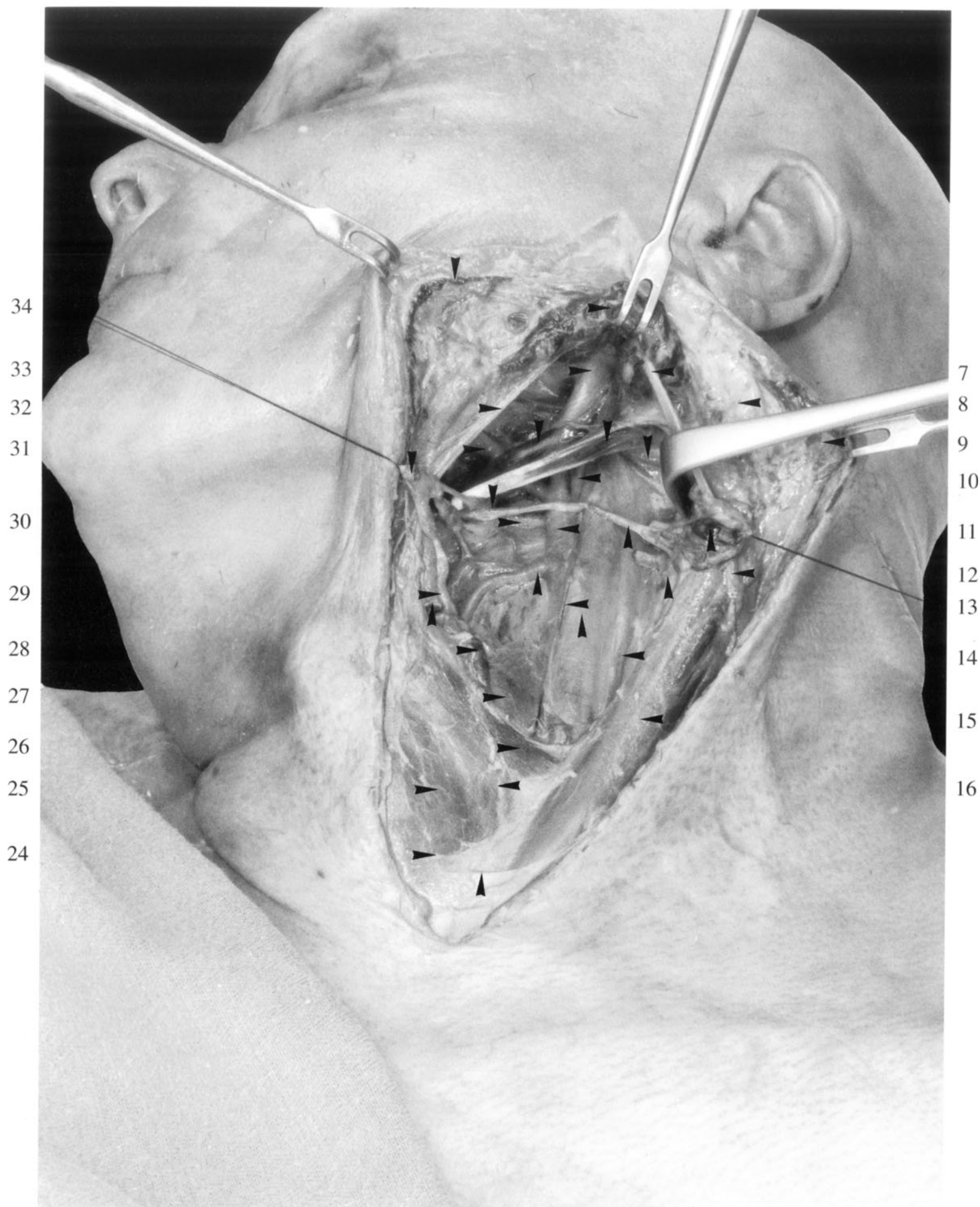


Figure 14 **Carotid Triangle 7**
Overall Structure

- | | | | |
|----|--|----|---|
| 1 | Platysma | 20 | Ansa cervicalis (anterior root) |
| 2 | Superficial cervical fascia (cut edge) | | (descending branch of hypoglossal nerve) |
| 3 | Thyrohyoid branch | 21 | Superior laryngeal nerve (internal branch) |
| 4 | Hypoglossal nerve | 22 | Lingual artery |
| 5 | Digastric muscle (posterior belly) | 23 | Thyrohyoid membrane |
| 6 | Sternocleidomastoid artery | 24 | Sternohyoid muscle |
| 7 | Mandibular angle | | (embedded in middle cervical fascia) |
| | (gonion: palpable bony prominence) | 25 | Sternoclavicular joint (position of joint spaces) |
| 8 | Retromandibular vein | 26 | Superficial cervical fascia (cut edge) |
| 9 | Retromandibular fossa | 27 | Middle cervical fascia |
| 10 | Parotid gland (cervical lobe) | | (pretracheal layer of cervical fascia) |
| 11 | Mastoid process (palpable bony prominence) | 28 | Omohyoid muscle (superior belly) |
| 12 | Internal carotid artery | 29 | Thyroid gland (left lobe, superior pole) |
| 13 | External carotid artery | 30 | Inferior pharyngeal constrictor muscle |
| 14 | Superior thyroid artery | | (thyropharyngeal part) |
| 15 | Superior laryngeal nerve (external branch) | 31 | Superior laryngeal artery |
| 16 | Common carotid artery | | and internal branch of superior laryngeal nerve |
| 17 | Accessory nerve | 32 | Greater cornu of hyoid bone |
| 18 | Sternocleidomastoid muscle | 33 | Hyoglossus muscle |
| 19 | Internal jugular vein | 34 | Facial nerve (cervical branch) |

1 2 3 4 5 6 7 8 9

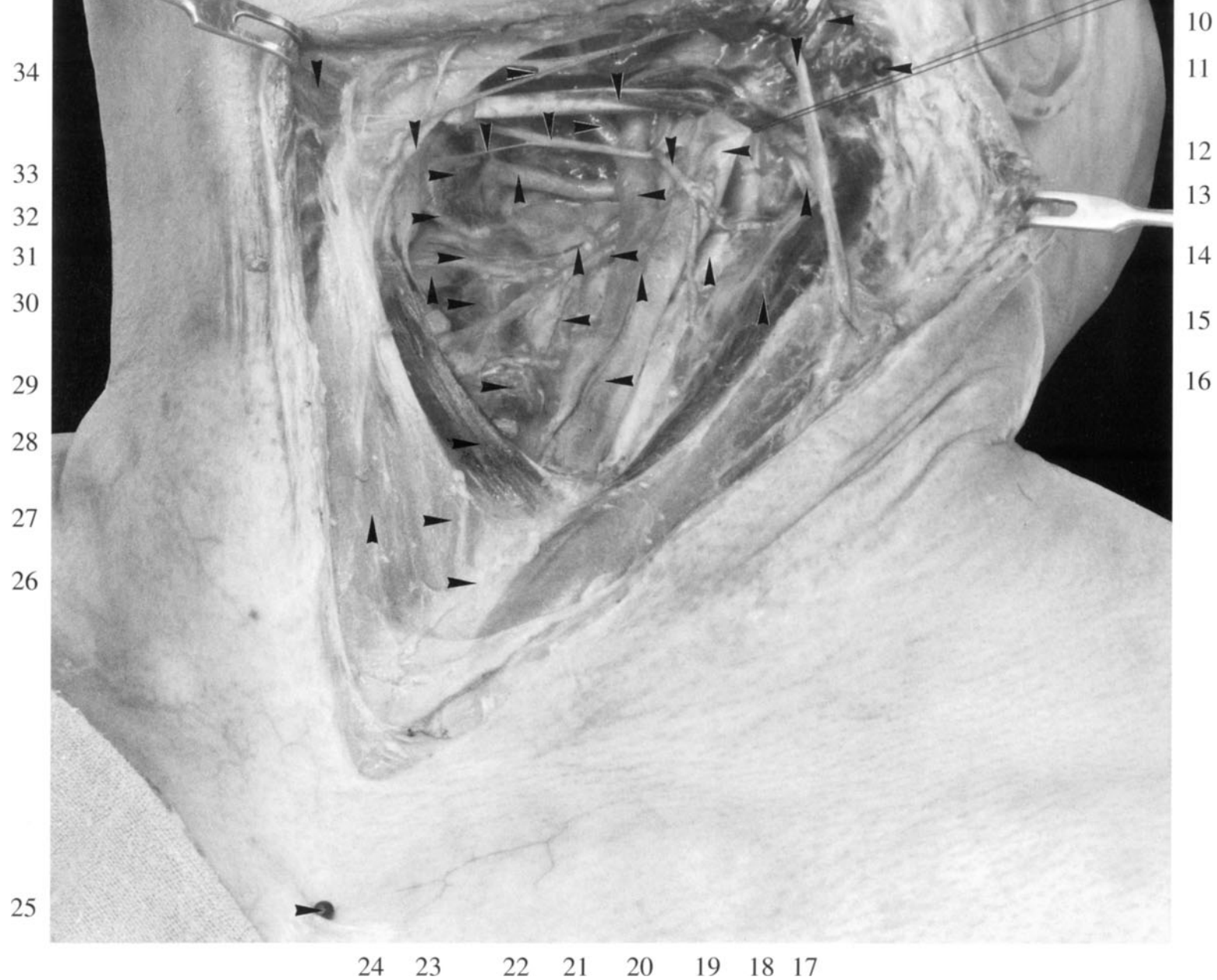


Figure 15

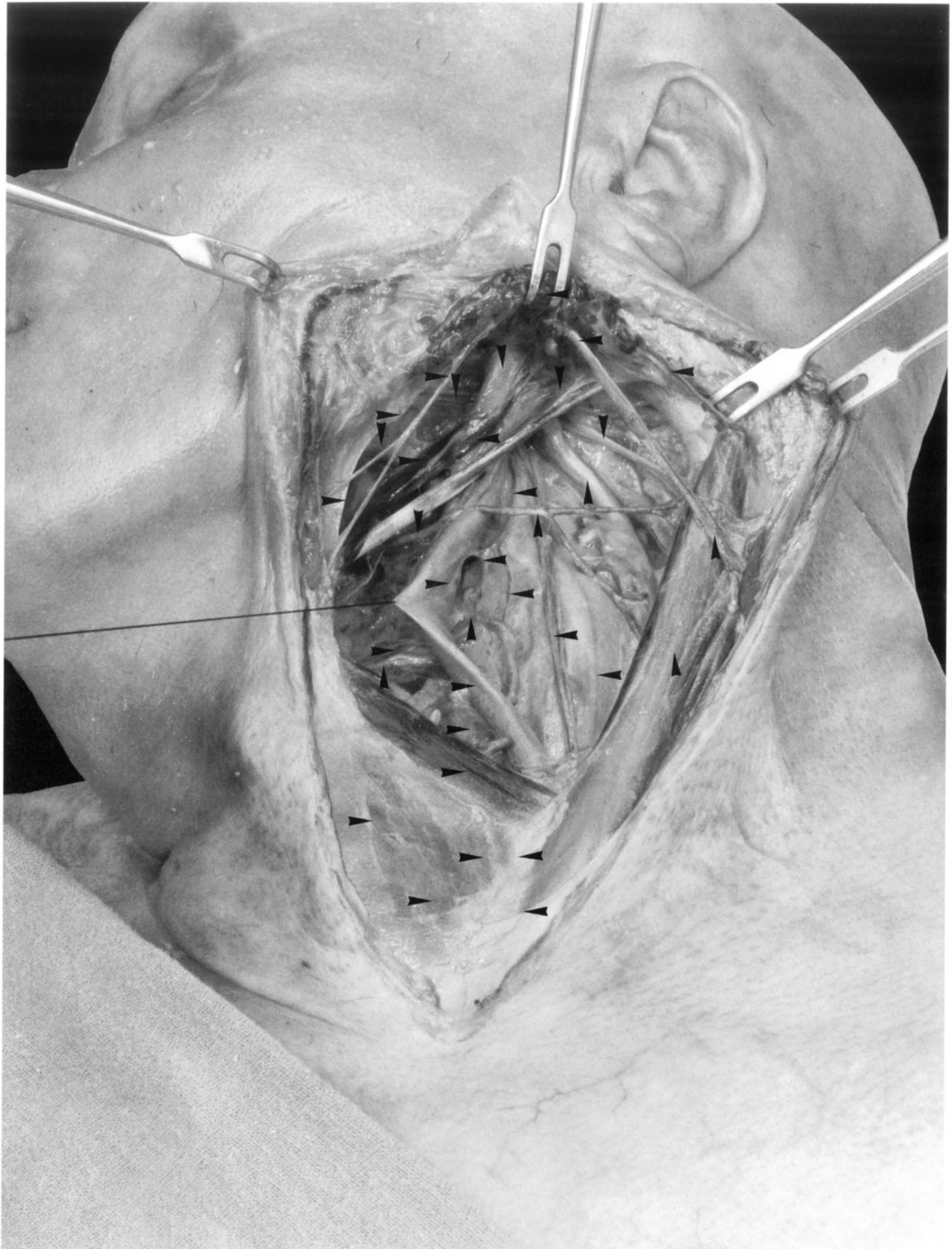
**Carotid Triangle 8
Neurovascular Structures**

- | | | | |
|----|---|----|--|
| 1 | Facial artery | 19 | Sternocleidomastoid muscle |
| 2 | Hypoglossal nerve | 20 | Sternocleidomastoid artery |
| 3 | Stylomandibular ligament | 21 | Deep layer of stratum subcutaneum (cut edge) |
| 4 | External carotid artery | 22 | Superior thyroid artery |
| 5 | Digastric muscle (posterior belly) | 23 | Superior laryngeal artery |
| 6 | Accessory nerve | 24 | Sternohyoid muscle
(embedded in middle cervical fascia) |
| 7 | Parotid gland (cervical lobe) | 25 | Middle cervical fascia
(pretracheal layer of cervical fascia) |
| 8 | Retromandibular vein | 26 | Superficial cervical fascia |
| 9 | Great auricular nerve | 27 | Omohyoid muscle |
| 10 | Stylohyoid muscle | 28 | Thyroid gland (left lobe, superior pole) |
| 11 | Superior laryngeal nerve | 29 | Common carotid artery |
| 12 | Superior laryngeal nerve (internal branch) | 30 | Superior laryngeal nerve (internal branch) |
| 13 | Superior laryngeal nerve (external branch) | 31 | Carotid body |
| 14 | Vagus nerve | 32 | Superficial cervical fascia |
| 15 | Sympathetic trunk | 33 | Styloglossus muscle |
| 16 | Superficial cervical fascia (cut edge) | 34 | Mandibular angle |
| 17 | Deep layer of stratum subcutaneum
(cut edge) | 35 | Facial nerve (cervical branch) |
| 18 | External jugular vein | | |

1 2 3 4 5 6

35
34
33
32
31
30
29
28
27
26
25
24

7
8
9
10
11
12
13
14
15
16
17



23 22 21 20 19 18

Figure 16

**Anterior Approach to the Cervical Spine
Puncture of the Intervertebral Disks**

- | | |
|---|--|
| 1 Internal carotid artery | 13 Superficial cervical fascia |
| 2 Digastric muscle (posterior belly) | 14 Carotid tubercle |
| 3 Third cervical nerve (anterior branch) | 15 Intervertebral disk between C6 and C7
(behind longus colli muscle) |
| 4 Accessory nerve | 16 Omohyoid muscle |
| 5 External jugular vein | 17 Common carotid artery |
| 6 Accessory nerve | 18 Intervertebral disk between C5 and C6
(behind longus colli muscle) |
| 7 Scalenus medius muscle | 19 Intercarotid layer of deep cervical fascia |
| 8 Ansa cervicalis (posterior root) | 20 Thyrolinguofacial trunk of internal jugular vein |
| 9 Longus capitis muscle | 21 Facial nerve (cervical branch) |
| 10 Sympathetic trunk | 22 Parotid gland (cervical lobe) |
| 11 Longus colli muscle (medial portion)
(rectus colli muscle of LUSCHKA) | 23 Parotid fascia |
| 12 Sternocleidomastoid muscle | |

1 2 3 4 5

23

22

21

20

19

18

17

6

7

8

9

10

11

16

15

14

13

12

Figure 17

**Carotid Triangle 9
Overall Structure (Right Side)**

- | | |
|--|--|
| 1 Sternocleidomastoid artery | 23 Omohyoid muscle |
| 2 Vagus nerve | 24 Thyrohyoid membrane |
| 3 Digastric muscle (posterior belly) | 25 Superior laryngeal artery |
| 4 Hypoglossal nerve | 26 Inferior pharyngeal constrictor muscle |
| 5 Hyoid bone (greater cornu) | 27 Superior thyroid artery
(sternocleidomastoid branch) |
| 6 Submandibular gland | 28 Superior thyroid vein |
| 7 Facial artery | 29 Sternocleidomastoid muscle (clavicular head) |
| 8 Facial nerve | 30 Carotid sheath |
| 9 Masseter muscle | 31 Ansa cervicalis (anterior root)
(descending branch of hypoglossal nerve) |
| 10 Parotid gland (deep part) | 32 Common carotid artery |
| 11 External carotid artery | 33 Internal jugular vein |
| 12 Stylohyoid muscle | 34 Sternocleidomastoid muscle |
| 13 Pharyngeal vein | 35 Carotid body |
| 14 Facial artery | 36 External carotid artery |
| 15 Internal carotid artery | 37 Accessory nerve |
| 16 Superior laryngeal nerve (internal branch) | 38 Occipital artery |
| 17 Superior laryngeal nerve (external branch) | 39 Internal jugular vein
in front of longus capitis muscle |
| 18 Superior thyroid artery | 40 Parotid gland (superficial part) |
| 19 Thyrohyoid muscle | |
| 20 Digastric muscle (anterior belly) | |
| 21 Mylohyoid muscle | |
| 22 Intermediate tendon of digastric muscle
(anchoring loop) | |

1 2 3 4 5 6 7

40

39

38

37

36

35

34

33

32

31

30

8

9

10

11

12

13

14

15

16

17

18

19

29

28

27

26

25

24

23

22

21

20

Figure 18 **Carotid Triangle 10**
Overall Structure (Right Side)

- | | | | |
|----|--|----|--|
| 1 | Transverse process of atlas | 24 | Digastric muscle |
| 2 | Facial nerve | | (intermediate tendon |
| 3 | Styloid process | | with fibrous anchoring loop) |
| 4 | Zygomatico-orbital artery | 25 | Greater cornu of hyoid bone |
| 5 | Submandibular gland | 26 | Superior laryngeal artery |
| 6 | Auriculotemporal nerve | 27 | Superior laryngeal nerve (internal branch) |
| 7 | Superior temporal artery | 28 | Carotid bifurcation |
| 8 | Stylohyoid muscle (tendon) | 29 | Omohyoid muscle (inferior belly) |
| 9 | External carotid artery | 30 | Ansa cervicalis (posterior root) |
| 10 | Masseter muscle | 31 | Internal jugular vein (collapsed) |
| 11 | Stylohyoid muscle | 32 | Ansa cervicalis (anterior root) |
| 12 | External carotid artery | | (descending branch of hypoglossal nerve) |
| 13 | Facial artery | 33 | Vagus nerve |
| 14 | Lingual artery | 34 | Sternocleidomastoid branch |
| 15 | Internal carotid artery | | from third cervical nerve |
| 16 | Superior thyroid artery | | and a branch of the sternocleidomastoid artery |
| 17 | Inferior pharyngeal constrictor muscle | 35 | Sternocleidomastoid muscle |
| | (thyropharyngeal part) | 36 | Superior laryngeal nerve (external branch) |
| 18 | Thyrohyoid muscle | 37 | Hypoglossal nerve |
| 19 | Carotid sheath (cut edge) | | and sternocleidomastoid artery |
| 20 | Omohyoid muscle (superior belly) | 38 | Pharyngeal vein |
| 21 | Middle cervical fascia | 39 | Accessory nerve |
| | (pretracheal layer of cervical fascia) | 40 | Digastric muscle (posterior belly) |
| 22 | Digastric muscle (anterior belly) | 41 | Posterior auricular artery |
| 23 | Mylohyoid muscle | 42 | Maxillary vein |
| | | | (drains to resected retromandibular vein) |
| | | 43 | Mastoid process |

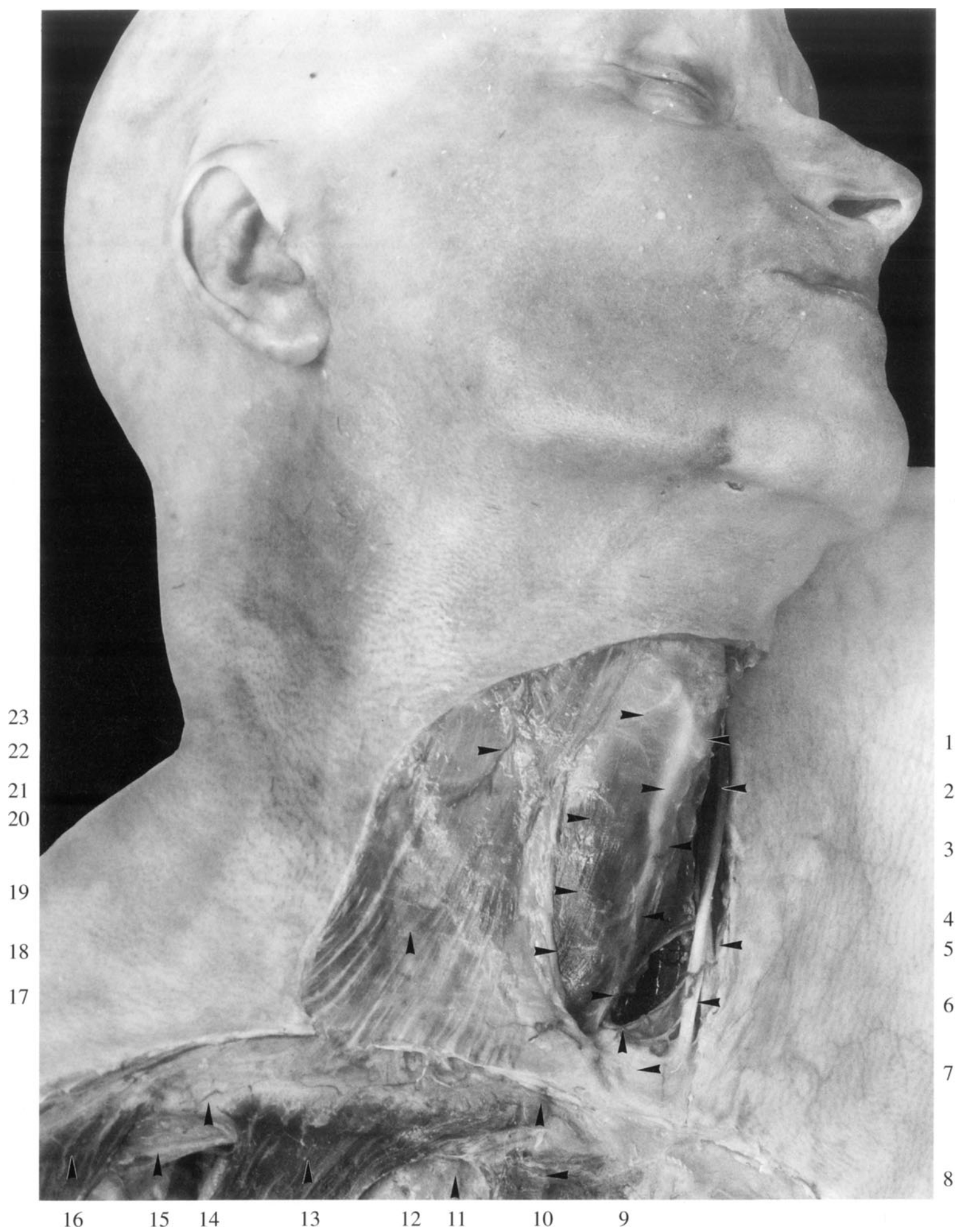
1 2 3 4 5



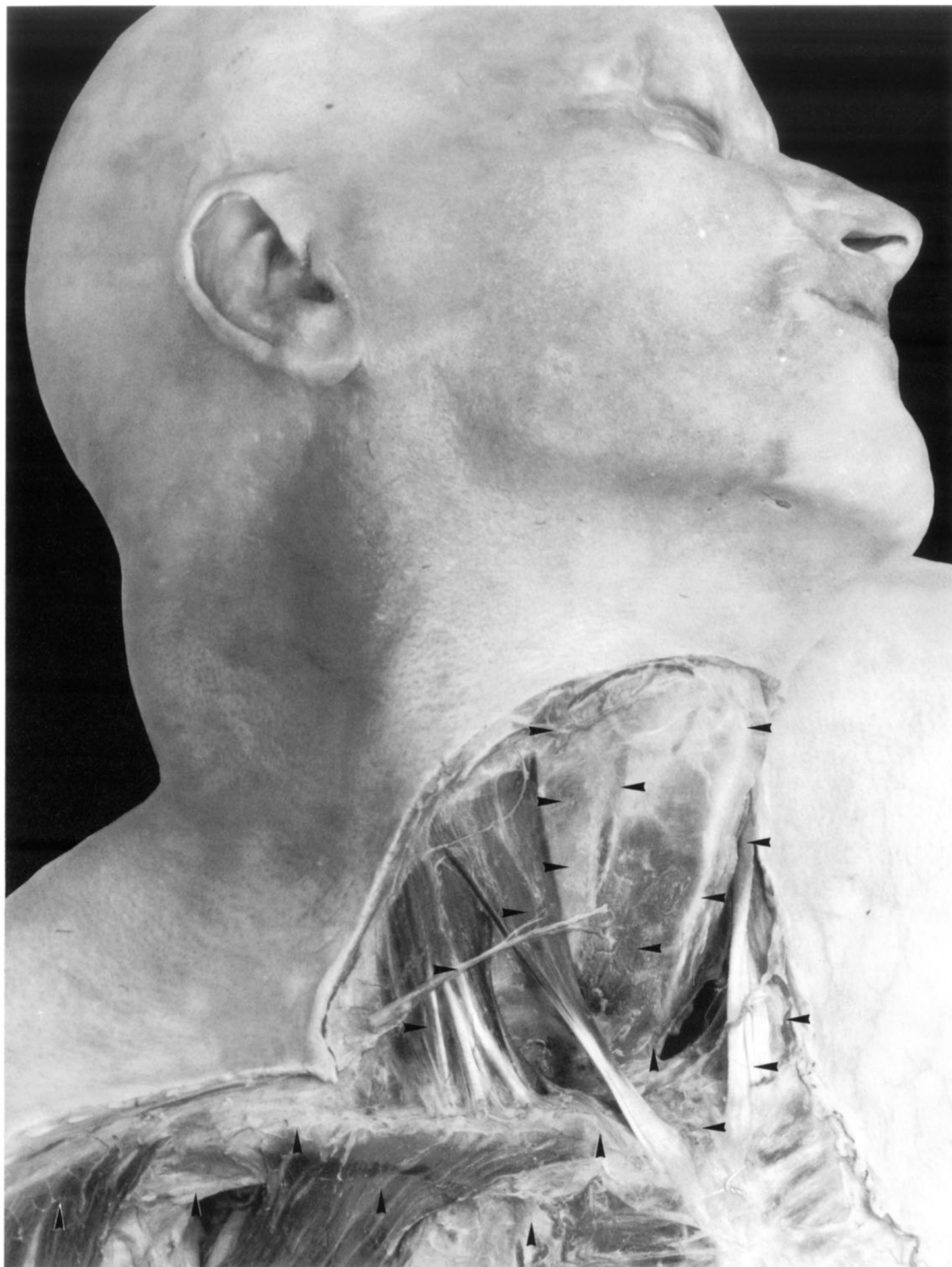
Figure 19

Thyroid Region 1

- | | | | |
|----|---|----|---|
| 1 | Laryngeal prominence | 13 | Pectoralis major muscle (clavicular part) |
| 2 | Sternocleidomastoid muscle | 14 | Clavicle in area of deltoid-pectoral triangle |
| 3 | Thyrohyoid muscle with bulge
caused by arch of cricoid cartilage | 15 | Coracoclavicular tract |
| 4 | Bulge of thyroid gland isthmus | 16 | Deltoid muscle |
| 5 | Anterior jugular vein
(superficial drainage to jugular arch) | 17 | Median vein of neck |
| 6 | Sternocleidomastoid muscle
(tendon of sternal head) | 18 | Superficial cervical fascia (cut edge) |
| 7 | Jugular notch of sternum | 19 | Bulge of midcervical fascia
(pretracheal layer of cervical fascia)
with embedded thyrohyoid muscle
through right lobe of thyroid gland |
| 8 | Pectoralis major muscle
(stump of sternocostal part) | 20 | Branch from anterior jugular vein
to median vein of neck |
| 9 | Jugular arch | 21 | Linea alba of neck |
| 10 | Sternoclavicular joint | 22 | Cutaneous branch of superior thyroid artery |
| 11 | First rib | 23 | Anterior jugular vein |
| 12 | Platysma | | |



- | | | | |
|----|---|----|---|
| 1 | Laryngeal prominence | 12 | Pectoralis major muscle (clavicular part) |
| 2 | Anterior jugular vein | 13 | Clavicle |
| 3 | Sternocleidomastoid muscle | 14 | Coracoclavicular tract |
| 4 | Linea alba of neck | 15 | Deltoid muscle |
| 5 | Sternothyroid muscle
(embedded in middle cervical fascia) | 16 | Sternocleidomastoid muscle (clavicular head) |
| 6 | Anterior jugular vein
(superficial drainage to jugular arch) | 17 | Medial branch of medial supraclavicular nerve
(suprasternal nerve) |
| 7 | Sternocleidomastoid muscle
(tendon of sternal head) | 18 | Sternocleidomastoid muscle (clavicular head) |
| 8 | Jugular notch of sternum | 19 | Middle cervical fascia
(pretracheal layer of cervical fascia) |
| 9 | Median vein of neck | 20 | Omohyoid muscle
(embedded in middle cervical fascia) |
| 10 | Sternoclavicular joint | 21 | Cutaneous branch of superior thyroid artery |
| 11 | First rib | | |



21
20
19
18
17
16

1
2
3
4
5
6
7
8

15 14 13 12 11 10 9

Figure 21**Thyroid Region 3**

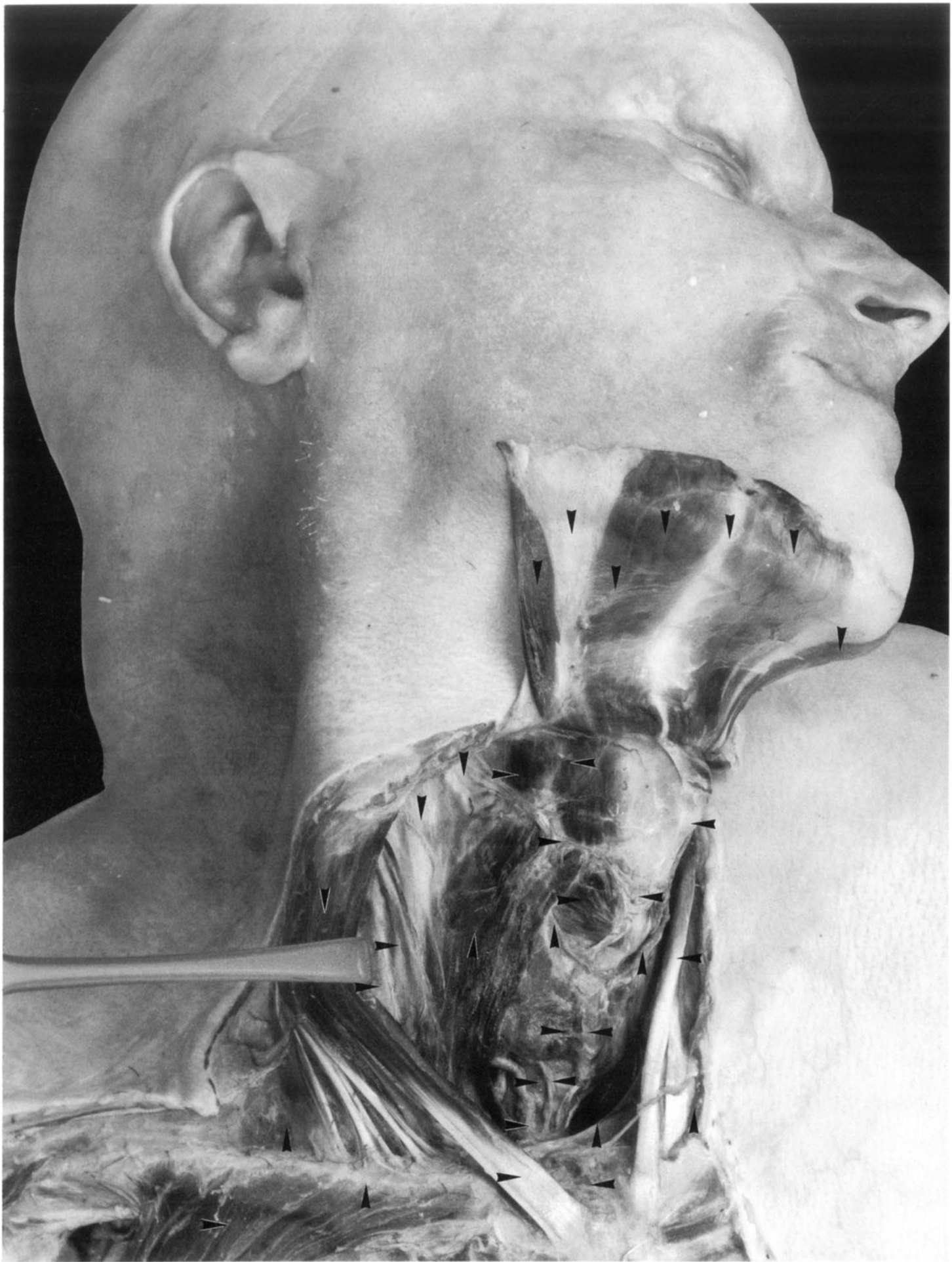
- | | | | |
|----|---|----|---|
| 1 | Sternocleidomastoid muscle | 18 | Anterior jugular vein |
| 2 | Longus colli muscle
(covered by deep cervical fascia) | | (superficial drainage to jugular arch) |
| 3 | Superior thyroid artery and vein | 19 | Superior thyroid vein |
| 4 | Omohyoid muscle | 20 | Middle cervical fascia
(pretracheal layer of cervical fascia) (cut edge) |
| 5 | Middle cervical fascia
(pretracheal layer of cervical fascia) | 21 | Superior thyroid artery (anterior branch) |
| 6 | Anterior jugular vein | 22 | Sternothyroid muscle |
| 7 | Sternohyoid muscle | 23 | Sternocleidomastoid muscle (clavicular head) |
| 8 | Linea alba of neck | 24 | Greater supraclavicular fossa |
| 9 | Sternohyoid muscle | 25 | Pectoralis major muscle (clavicular part) |
| 10 | Omohyoid muscle | 26 | Sternocleidomastoid muscle
(tendon of sternal head) |
| 11 | Thyrohyoid muscle | 27 | Inferior thyroid veins (unpaired thyroid plexus) |
| 12 | Laryngeal prominence | 28 | Trachea |
| 13 | Conus elasticus
with median cricothyroid ligament | 29 | Isthmus of thyroid gland |
| 14 | Sternocleidomastoid muscle (sternal head) | 30 | Common carotid artery in carotid sheath |
| 15 | Communicating vein
between superior and inferior thyroid veins | 31 | Transected bundles of sternothyroid muscle |
| 16 | Inferior thyroid vein | 32 | Cricothyroid muscle |
| 17 | Jugular notch of sternum | 33 | Cricothyroid branch of superior thyroid artery |
| | | 34 | Inferior pharyngeal constrictor muscle
(thyropharyngeal part) |

1 2 3 4 5 6 7 8 9 10

34
33
32
31
30
29
28
27
26
25

11
12
13
14
15
16
17

24 23 22 21 20 19 18



- 1 Sternocleidomastoid muscle
- 2 Common carotid artery
- 3 Omohyoid muscle
- 4 Middle cervical fascia
(pretracheal layer of cervical fascia)
- 5 Anterior jugular vein
- 6 Sternohyoid muscle
- 7 Linea alba of neck
- 8 Sternohyoid muscle
- 9 Omohyoid muscle
- 10 Middle cervical fascia
(pretracheal layer of cervical fascia)
- 11 Superior thyroid notch
- 12 Thyrohyoid muscle
- 13 Cricothyroid branch of superior thyroid artery
- 14 Conus elasticus
with median cricothyroid ligament
- 15 Communicating vein
between cricothyroid branch
and inferior thyroid vein
- 16 Sternocleidomastoid muscle
(tendon of sternal head)
- 17 Communicating vein
between superior and inferior thyroid veins
- 18 Inferior thyroid vein
- 19 Jugular notch of sternum
- 20 Middle cervical fascia
(pretracheal layer of cervical fascia) (cut edge)
- 21 Isthmus of thyroid gland
- 22 Sternocleidomastoid muscle
(tendon of sternal head)
- 23 Right lobe of thyroid gland
- 24 Sternocleidomastoid muscle (clavicular belly)
- 25 Greater supraclavicular fossa
- 26 Inferior thyroid veins (unpaired thyroid plexus)
- 27 Trachea
- 28 Internal jugular vein
- 29 Superior cardiac branch
- 30 Detached bundle of sternothyroid muscle
- 31 Cricothyroid muscle
- 32 Superior thyroid artery (anterior branch)
- 33 Superior laryngeal nerve (external branch)

1 2 3 4 5 6 7 8 9 10

33
32
31
30
29
28
27
26

11
12
13
14
15
16
17
18
19

25 24 23 22 21 20

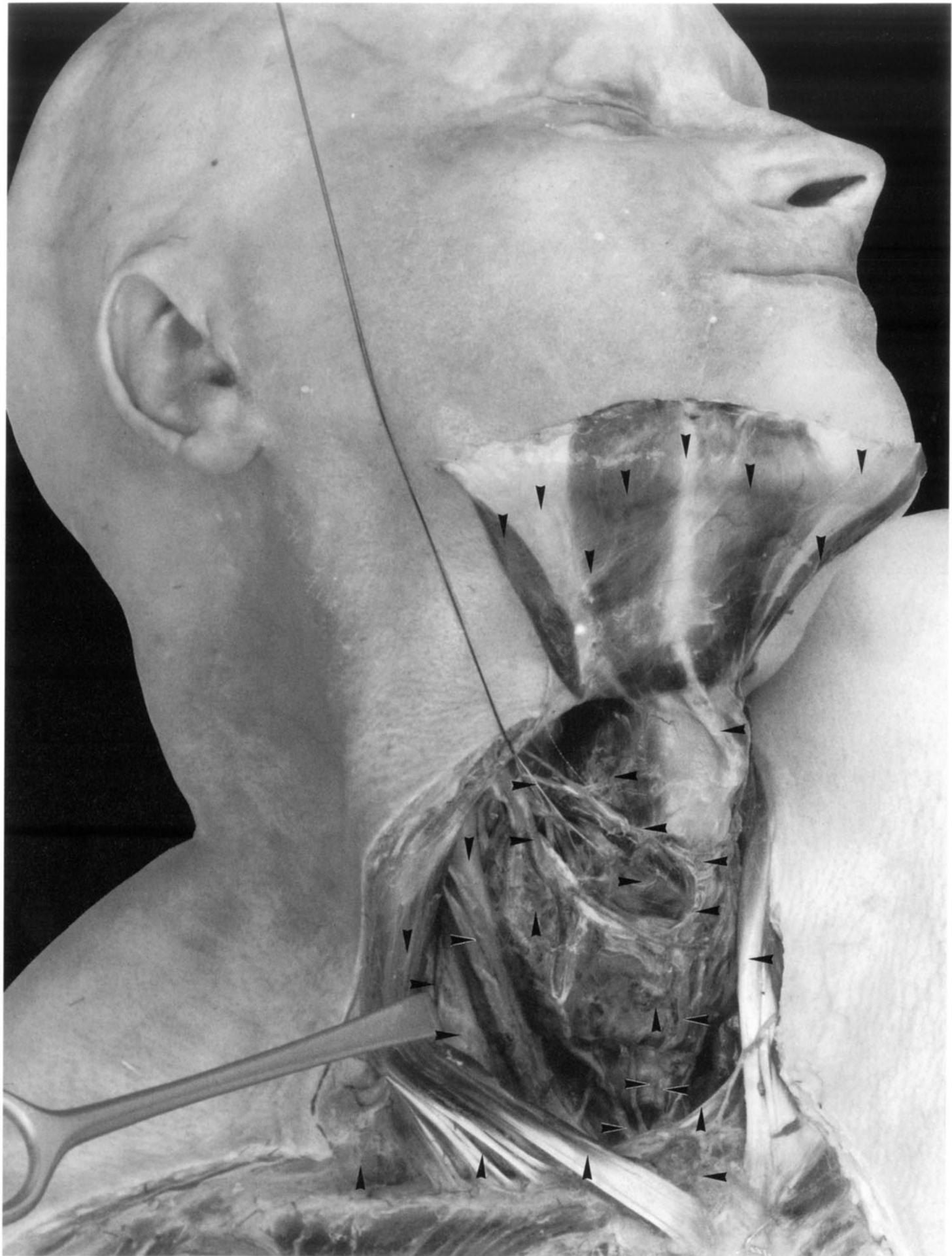


Figure 23**Thyroid Region 5**

- | | | | |
|----|---|----|---|
| 1 | Common carotid artery | 20 | Pectoralis major muscle |
| 2 | Longus colli muscle | | (stump of sternocostal part) |
| | (covered by deep cervical fascia) | 21 | Middle cervical fascia |
| 3 | Omohyoid muscle | | (pretracheal layer of cervical fascia) (cut edge) |
| 4 | Middle cervical fascia | 22 | Trachea |
| | (pretracheal layer of cervical fascia) | 23 | Sternocleidomastoid muscle |
| 5 | Anterior jugular vein | | (tendon of sternal head) |
| 6 | Sternohyoid muscle | 24 | Inferior thyroid artery |
| 7 | Linea alba of neck | 25 | Sternocleidomastoid muscle (clavicular head) |
| 8 | Sternohyoid muscle | 26 | Sternocleidomastoid muscle |
| 9 | Omohyoid muscle | 27 | Pectoralis major muscle (clavicular part) |
| 10 | Middle cervical fascia | 28 | Coracoclavicular tract |
| | (pretracheal layer of cervical fascia) | 29 | Inferior thyroid vein |
| 11 | Superior thyroid artery | 30 | Middle thyroid vein |
| 12 | Thyrohyoid muscle | 31 | Recurrent laryngeal nerve |
| 13 | Laryngeal prominence | 32 | Superior cardiac branch of vagus nerve |
| 14 | Superior parathyroid gland | 33 | Vagus nerve |
| 15 | Right lobe of thyroid gland | 34 | Sympathetic trunk |
| 16 | Inferior parathyroid gland | | (covered by intercarotid layer |
| 17 | Sternocleidomastoid muscle (sternal head) | | of deep cervical fascia) |
| 18 | Unpaired thyroid plexus | 35 | Superior pole of right lobe of thyroid gland |
| 19 | Jugular notch of sternum | 36 | Superior thyroid vein |

1 2 3 4 5 6 7 8 9 10

36
35
34
33
32
31
30
29

11
12
13
14
15
16
17
18
19
20

28 27 26 25 24 23 22 21

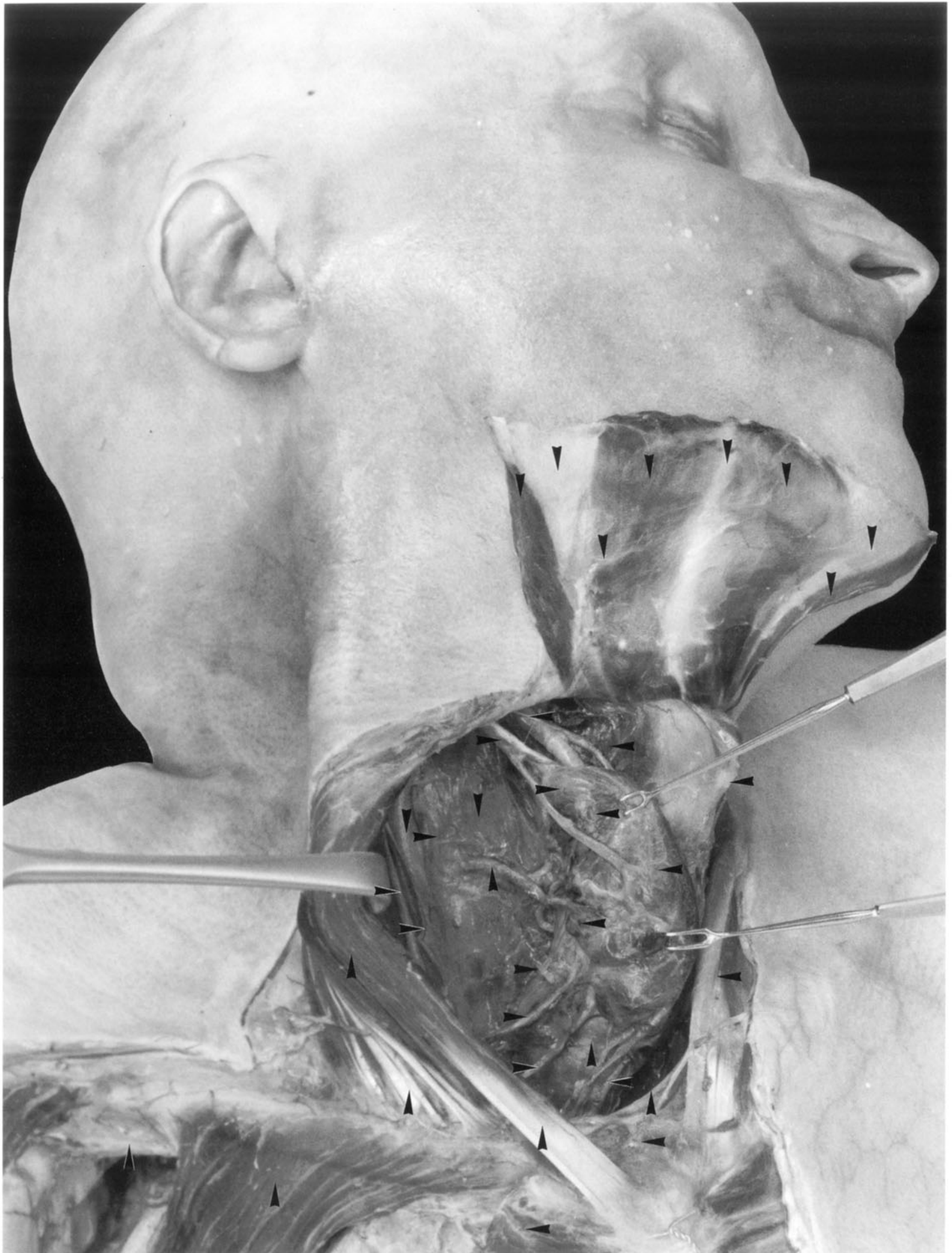


Figure 24**Thyroid Region 6
Recurrent Laryngeal Nerve (Right Side)**

- | | | | |
|----|--|----|---|
| 1 | Intervertebral disks between C5 and C7 | 20 | Thyroid gland (inferior pole) |
| 2 | Omohyoid muscle | 21 | Lateral thyroid ligament |
| 3 | Middle cervical fascia
(pretracheal layer of cervical fascia) | 22 | Middle thyroid vein |
| 4 | Anterior jugular vein | 23 | Inferior thyroid artery |
| 5 | Sternohyoid muscle | 24 | Inferior thyroid artery
(covered by intercarotid layer
of deep cervical fascia) |
| 6 | Linea alba of neck | 25 | Common carotid artery in carotid sheath |
| 7 | Sternohyoid muscle | 26 | Sternocleidomastoid muscle |
| 8 | Thyroid cartilage (right lamina) | 27 | Recurrent laryngeal nerve |
| 9 | Thyrohyoid muscle | 28 | Recurrent laryngeal nerve (esophageal branch) |
| 10 | Thyroid gland (superior pole) | 29 | Esophagus |
| 11 | Arterial branch to superior parathyroid gland | 30 | Inferior thyroid artery (esophageal branch) |
| 12 | Inferior laryngeal artery | 31 | Inferior thyroid artery (pharyngeal branch) |
| 13 | Inferior parathyroid gland | 32 | Longus colli muscle
(covered by deep cervical fascia) |
| 14 | Inferior laryngeal nerve | 33 | Inferior pharyngeal constrictor muscle |
| 15 | Recurrent laryngeal nerve (tracheal branch) | 34 | Superior laryngeal nerve (external branch) |
| 16 | Paratracheal lymph node | 35 | Superior thyroid vein |
| 17 | Trachea | | |
| 18 | Unpaired thyroid plexus | | |
| 19 | Sternocleidomastoid muscle
(tendon of sternal head) | | |

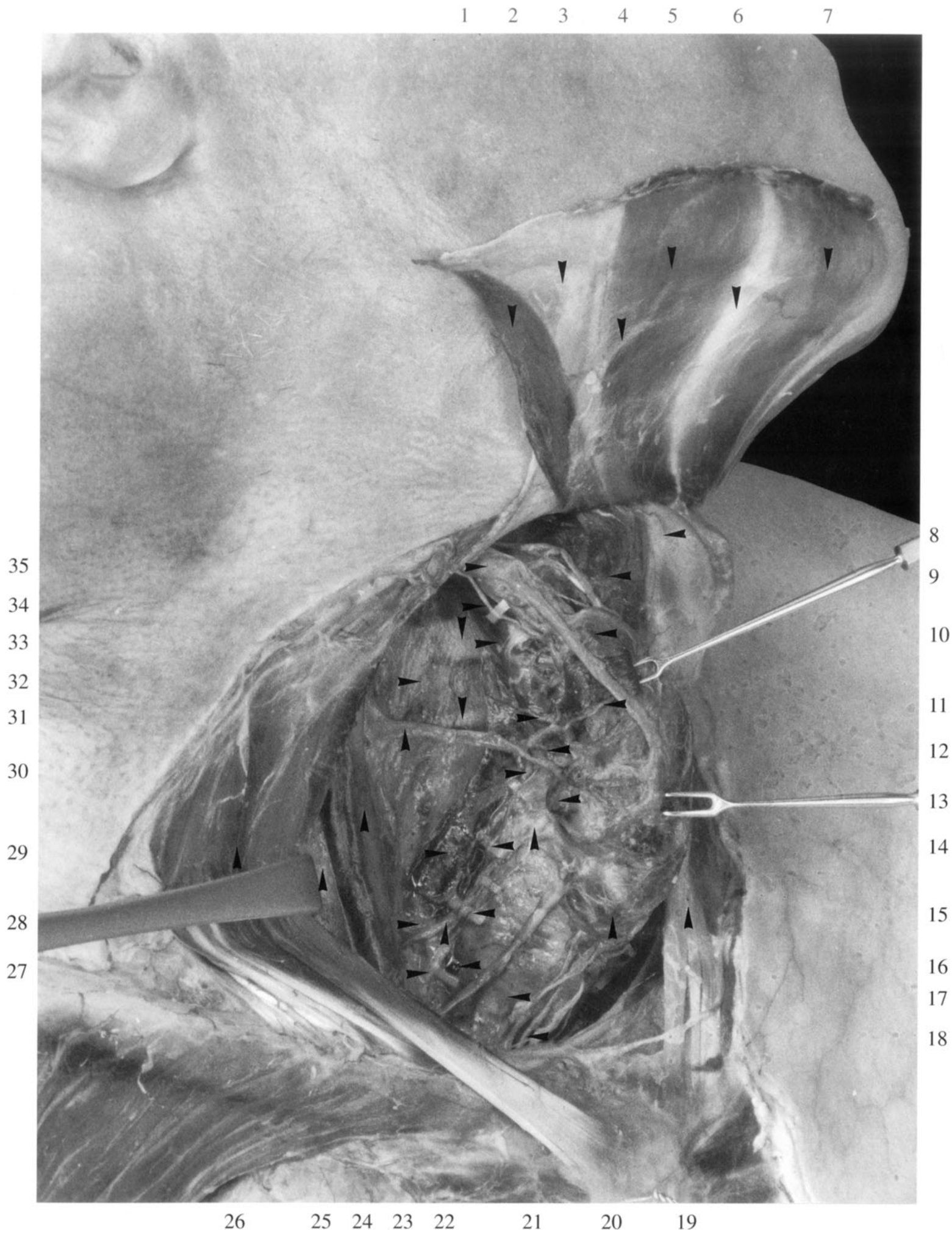


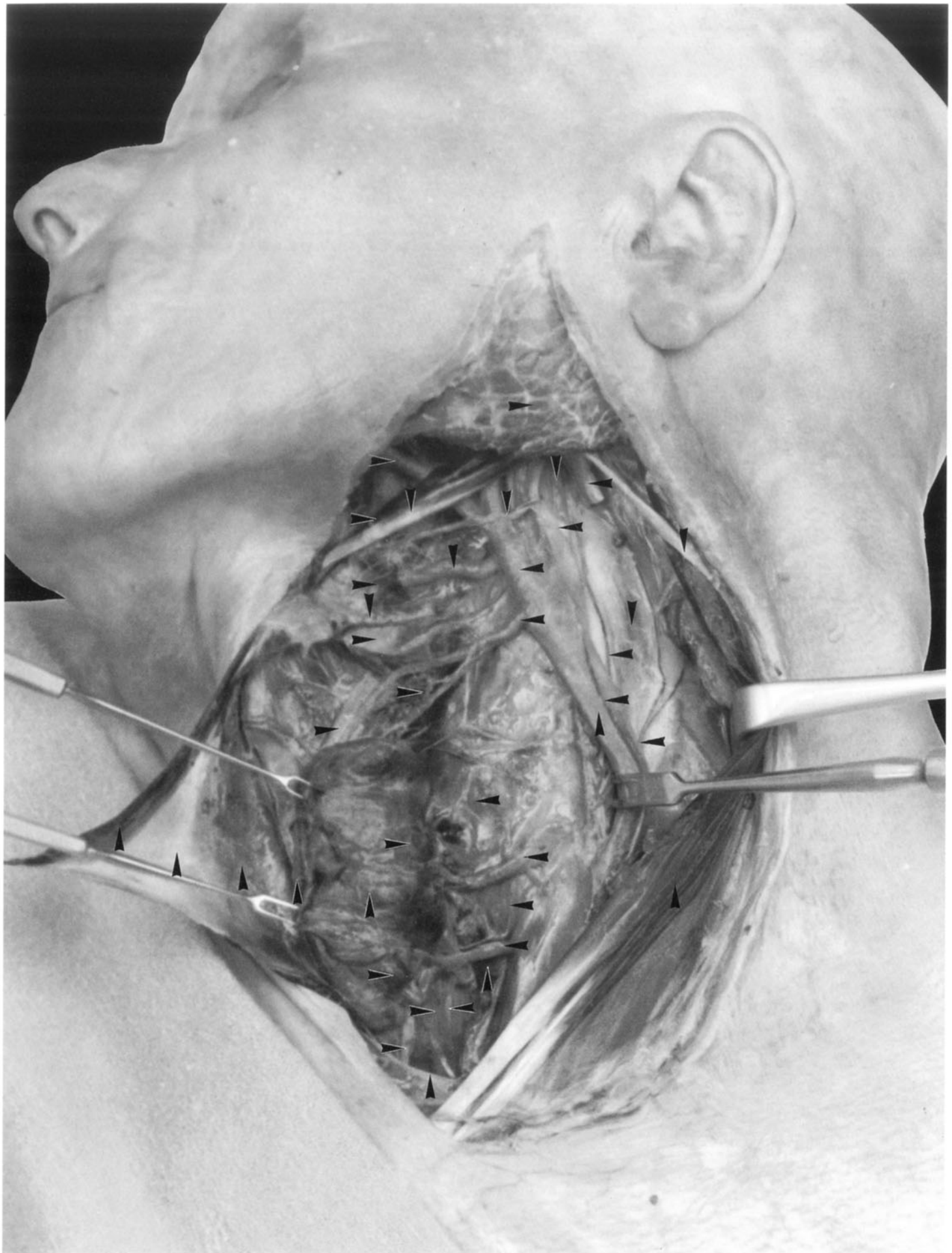
Figure 25**Thyroid Region 7
(Left Side)**

- | | | | |
|----|--|----|---|
| 1 | Hyoid bone (greater cornu) | 20 | Sternocleidomastoid muscle |
| 2 | Digastric muscle (posterior belly) | 21 | Common carotid artery
(partly without carotid sheath) |
| 3 | Lingual artery | 22 | Esophagus |
| 4 | Hypoglossal nerve | 23 | Middle cervical fascia
(pretracheal layer of cervical fascia) (cut edge) |
| 5 | Vagus nerve | 24 | Thyroid gland (left lobe) |
| 6 | Longus colli muscle with deep cervical fascia
(prevertebral layer of cervical fascia) | 25 | Sternothyroid muscle |
| 7 | External jugular vein | 26 | Sternohyoid muscle |
| 8 | Internal jugular vein | 27 | Middle cervical fascia
(pretracheal layer of cervical fascia) |
| 9 | Internal carotid artery | 28 | Omohyoid muscle |
| 10 | External carotid artery | 29 | Inferior thyroid vein |
| 11 | Superior thyroid artery | 30 | Trachea |
| 12 | Sympathetic trunk | 31 | Inferior parathyroid gland |
| 13 | Ansa cervicalis (anterior root)
(descending branch of hypoglossal nerve) | 32 | Superior parathyroid gland |
| 14 | Ansa cervicalis (posterior root) | 33 | Superior thyroid vein |
| 15 | Longus colli muscle
(covered by deep cervical fascia) | 34 | Inferior pharyngeal constrictor muscle |
| 16 | Inferior thyroid artery (superior branch) | 35 | Thyrohyoid membrane |
| 17 | Deep cervical fascia
(cut edge of intercarotid layer) | 36 | Hyoglossus muscle |
| 18 | Inferior thyroid artery (inferior branch) | 37 | Stylohyoid muscle |
| 19 | Recurrent laryngeal nerve | 38 | Facial artery |
| | | 39 | Parotid gland |

1 2 3 4 5 6 7

39
38
37
36
35
34
33
32
31
30
29

8
9
10
11
12
13
14
15
16
17
18
19



28 27 26 25 24 23 22 21 20

Figure 26

**Thyroid Region 8
Recurrent Laryngeal Nerve (Left Side)**

- | | |
|--|--|
| 1 Omohyoid muscle | 20 Superior thyroid artery (superior branch) |
| 2 Thyroid gland (left lobe) | 21 Recurrent laryngeal nerve (pharyngeal branch) |
| 3 Thyrohyoid muscle | 22 Inferior thyroid artery (inferior branch) |
| 4 Inferior pharyngeal constrictor muscle | 23 Trachea |
| 5 Hyoid bone (greater cornu) | 24 Sternocleidomastoid muscle |
| 6 Superior laryngeal artery | 25 Ansa cervicalis (posterior root) |
| 7 Stylohyoid muscle | 26 Common carotid artery with ansa cervicalis
(anterior root) |
| 8 Lingual artery | 27 Superior thyroid artery |
| 9 Hypoglossal nerve | 28 Deep cervical fascia
(cut edge of intercarotid layer) |
| 10 Internal carotid artery | 29 Esophagus |
| 11 Digastric muscle (posterior belly) | 30 Recurrent laryngeal nerve |
| 12 Occipital artery | 31 Sternothyroid muscle |
| 13 Superior cervical ganglion | 32 Sternohyoid muscle |
| 14 External carotid artery | 33 Unpaired thyroid plexus |
| 15 Vagus nerve | 34 Recurrent laryngeal nerve (tracheal branch) |
| 16 Sympathetic trunk
(covered by deep cervical fascia) | 35 Inferior parathyroid gland |
| 17 Longus capitis muscle
(covered by deep cervical fascia) | 36 Inferior laryngeal nerve |
| 18 Deep cervical fascia
(cut edge of intercarotid layer) | 37 Superior parathyroid gland |
| 19 Longus colli muscle
(covered by prevertebral layer
of deep cervical fascia) | 38 Superior laryngeal nerve (external branch) |
| | 39 Hyoglossus muscle |
| | 40 Parotid gland |

1

2

3

4

5

6

7

8

9

10

40

39

38

37

36

35

34

33

11

12

13

14

15

16

17

18

19

20

21

22

23

32

31

30

29

28

27

26

25

24

Figure 27

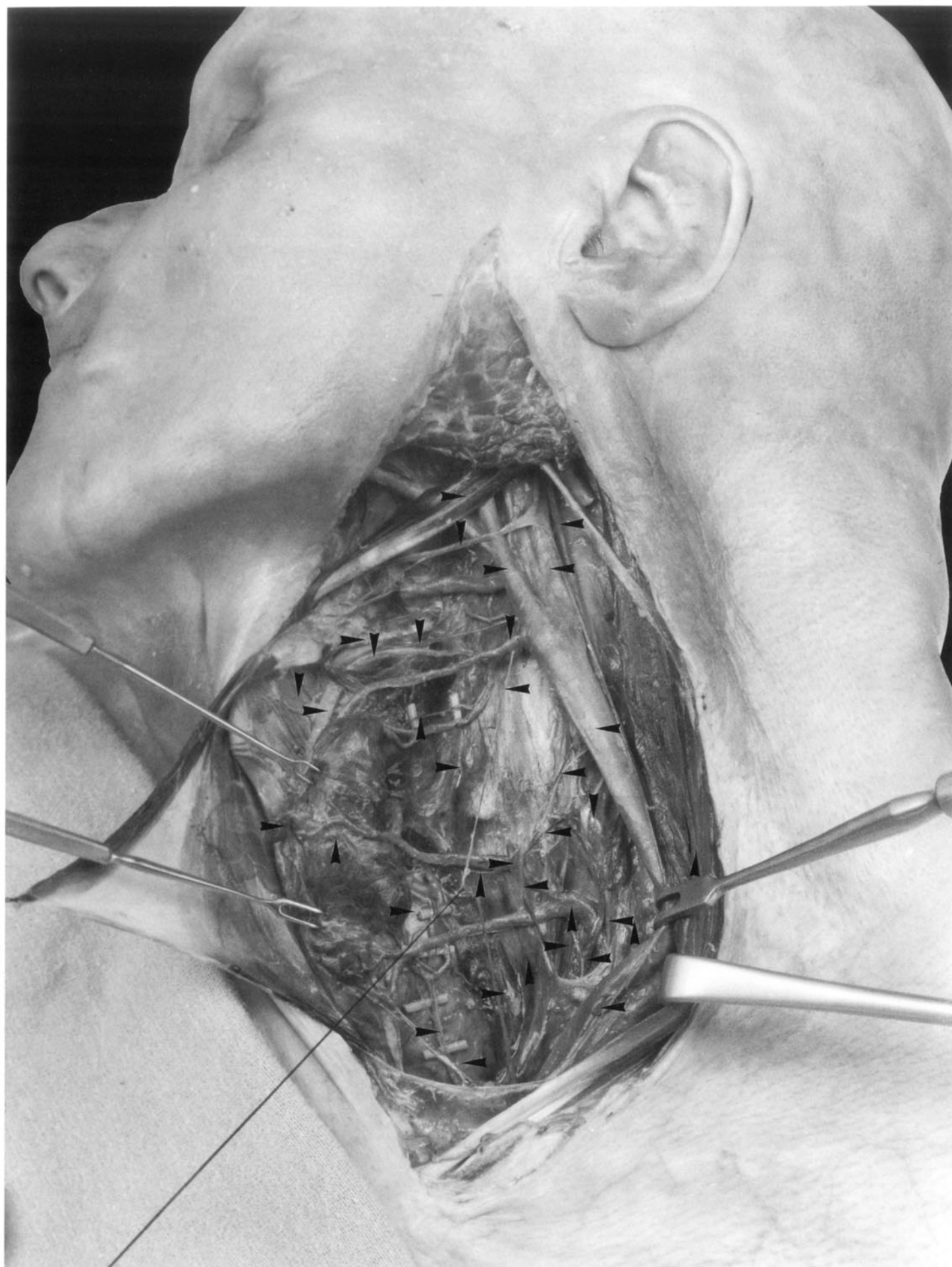
**Thyroid Region 9
Scalenovertebral Triangle 1**

- | | | | |
|----|--|----|---|
| 1 | Thyrohyoid muscle | 19 | Scalenus anterior muscle |
| 2 | Superior laryngeal artery | 20 | Inferior thyroid artery |
| 3 | Superior laryngeal nerve (internal branch) | 21 | Vertebropleural ligament |
| 4 | Hypoglossal nerve | 22 | Middle cervical cardiac nerve |
| 5 | Superior thyroid artery | 23 | Superior laryngeal nerve (external branch) |
| 6 | Carotid tubercle | 24 | Thyroid gland (left lobe) |
| 7 | Vagus nerve | 25 | Recurrent laryngeal nerve |
| 8 | Internal carotid artery | 26 | Esophagus |
| 9 | Superior cervical cardiac branch | 27 | Vertebral artery |
| 10 | Common carotid artery | 28 | Lateral thyroid ligament |
| 11 | Sympathetic trunk | 29 | Middle cervical ganglion |
| 12 | Communicating branch for C7 of brachial plexus | 30 | Middle thyroid vein (resected) |
| 13 | Sympathetic trunk | 31 | Retropharyngeal space |
| 14 | Ascending cervical artery | 32 | Superior thyroid vein (resected) |
| 15 | Vertebral vein | 33 | Hyoid bone (greater cornu) |
| 16 | Middle thyroid vein (resected) | 34 | External carotid artery |
| 17 | Trachea | 35 | Digastric muscle (posterior belly)
and stylohyoid muscle |
| 18 | Sternocleidomastoid muscle | | |

1 2 3 4 5 6

35
34
33
32
31
30
29
28
27
26
25

7
8
9
10
11
12
13
14
15
16
17



24 23 22 21 20 19 18

Figure 28**Thyroid Region 10
Scalenovertebral Triangle 2**

- | | | | |
|----|--|----|--|
| 1 | Left lobe of thyroid gland | 21 | Sternocleidomastoid muscle |
| 2 | Superior thyroid vein (resected) | 22 | Scalenus anterior muscle |
| 3 | Superior laryngeal artery | 23 | Ansa subclavia |
| 4 | Superior laryngeal nerve (internal branch) | 24 | Recurrent laryngeal nerve |
| 5 | Digastric muscle (posterior belly) | 25 | Trachea |
| 6 | Hypoglossal nerve | 26 | Unpaired thyroid plexus |
| 7 | Longus capitis muscle | 27 | Sternothyroid muscle |
| 8 | External jugular vein | 28 | Sternohyoid muscle |
| 9 | Internal carotid artery | 29 | Middle cervical fascia
(pretracheal layer of cervical fascia) |
| 10 | Ansa cervicalis (anterior root)
(descending branch of hypoglossal nerve) | 30 | Omohyoid muscle |
| 11 | Carotid bifurcation | 31 | Inferior cervical cardiac nerve |
| 12 | Superior cervical cardiac branch | 32 | Vertebral ganglion |
| 13 | (Prevertebral vein) | 33 | Deep cervical artery |
| 14 | Sympathetic trunk | 34 | Sympathetic trunk |
| 15 | Communicating branch for C6 of brachial plexus | 35 | Middle cervical cardiac nerve |
| 16 | Middle cervical ganglion | 36 | Inferior pharyngeal constrictor muscle |
| 17 | Ascending cervical artery | 37 | Superior laryngeal nerve (external branch) |
| 18 | Inferior thyroid artery | 38 | Thyrohyoid muscle |
| 19 | Vertebral artery and communicating branches
for brachial plexus (inferior part) | 39 | Hyoid bone (greater cornu) |
| 20 | Vertebral vein | 40 | External carotid artery |
| | | 41 | Stylohyoid muscle |

1 2 3 4 5 6 7 8

41
40
39
38
37
36
35
34
33
32
31

9
10
11
12
13
14
15
16
17
18
19
20

30 29 28 27 26 25 24 23 22 21

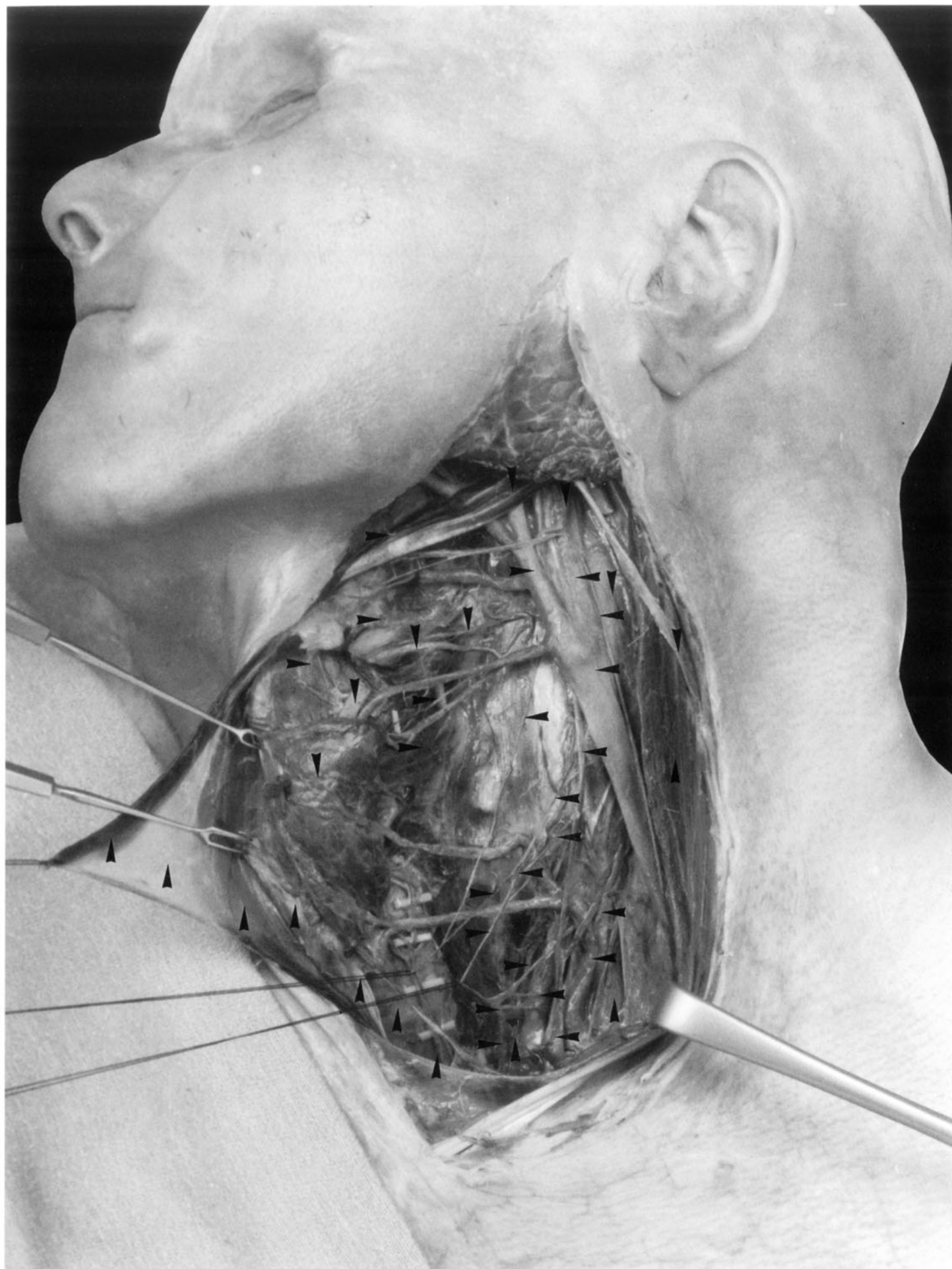


Figure 29 **Scalenovertebral Triangle 3**
Thoracic Duct

- | | | | |
|----|--|----|--|
| 1 | Sternohyoid muscle | 15 | Thoracic duct |
| 2 | Sternocleidomastoid muscle | 16 | Clavicle |
| 3 | Hypoglossal nerve | 17 | Omohyoid muscle (inferior belly) |
| 4 | Vertebral ganglion | 18 | Transverse cervical artery |
| 5 | Scalenus anterior muscle
covered by deep cervical fascia
(prevertebral layer of cervical fascia) | 19 | Supraclavicular lymph node |
| 6 | Scalenus medius muscle
covered by deep cervical fascia | 20 | Vertebropleural ligament |
| 7 | External carotid artery | 21 | Paratracheal lymph node |
| 8 | Ansa cervicalis (anterior root) | 22 | Paratracheal lymph node |
| 9 | Carotid tubercle | 23 | Subclavian artery
behind vertebropleural ligament |
| 10 | Ascending cervical artery | 24 | Esophagus |
| 11 | Lateral cervical lymph node | 25 | Middle cervical fascia
(pretracheal layer of cervical fascia) |
| 12 | Left jugular trunk | 26 | Inferior thyroid artery |
| 13 | Thoracic duct | 27 | Sympathetic trunk |
| 14 | Thoracic duct | 28 | Superior thyroid artery |
| | | 29 | Lingual vein |

1 2 3 4 5 6

29

28

27

26

25

24

23

7

8

9

10

11

12

13

14

15

16

22 21 20 19 18 17

Figure 30

**Lateral Cervical Region 1
(Right Side)**

- | | | | |
|----|---|----|---|
| 1 | Sternocleidomastoid muscle | 14 | Brachial plexus behind deep cervical fascia |
| 2 | Facial vein | 15 | Transverse cervical artery |
| 3 | Angular tract of superficial cervical fascia | 16 | Superficial cervical fascia (cut edge) |
| 4 | External jugular vein | 17 | Transverse cervical artery
(superficial descending branch) |
| 5 | Superficial cervical fascia (cut edge) | 18 | Superficial cervical fascia (cut edge) |
| 6 | Ascending cervical artery | 19 | Supraclavicular nerves |
| 7 | Scalenus anterior muscle | 20 | Scalenus medius muscle
(covered by deep cervical fascia) |
| 8 | Phrenic nerve (covered by deep cervical fascia) | 21 | Superficial cervical fascia (cut edge) |
| 9 | Omohyoid muscle (intermediate tendon) | 22 | Accessory nerve |
| 10 | Middle cervical fascia
(prevertebral layer of cervical fascia) | 23 | Trapezius muscle |
| 11 | Clavicle | 24 | Great auricular nerve (anterior branch) |
| 12 | Thoracic branch of suprascapular artery | 25 | Great auricular nerve (posterior branch) |
| 13 | Transverse cervical nerve | | |

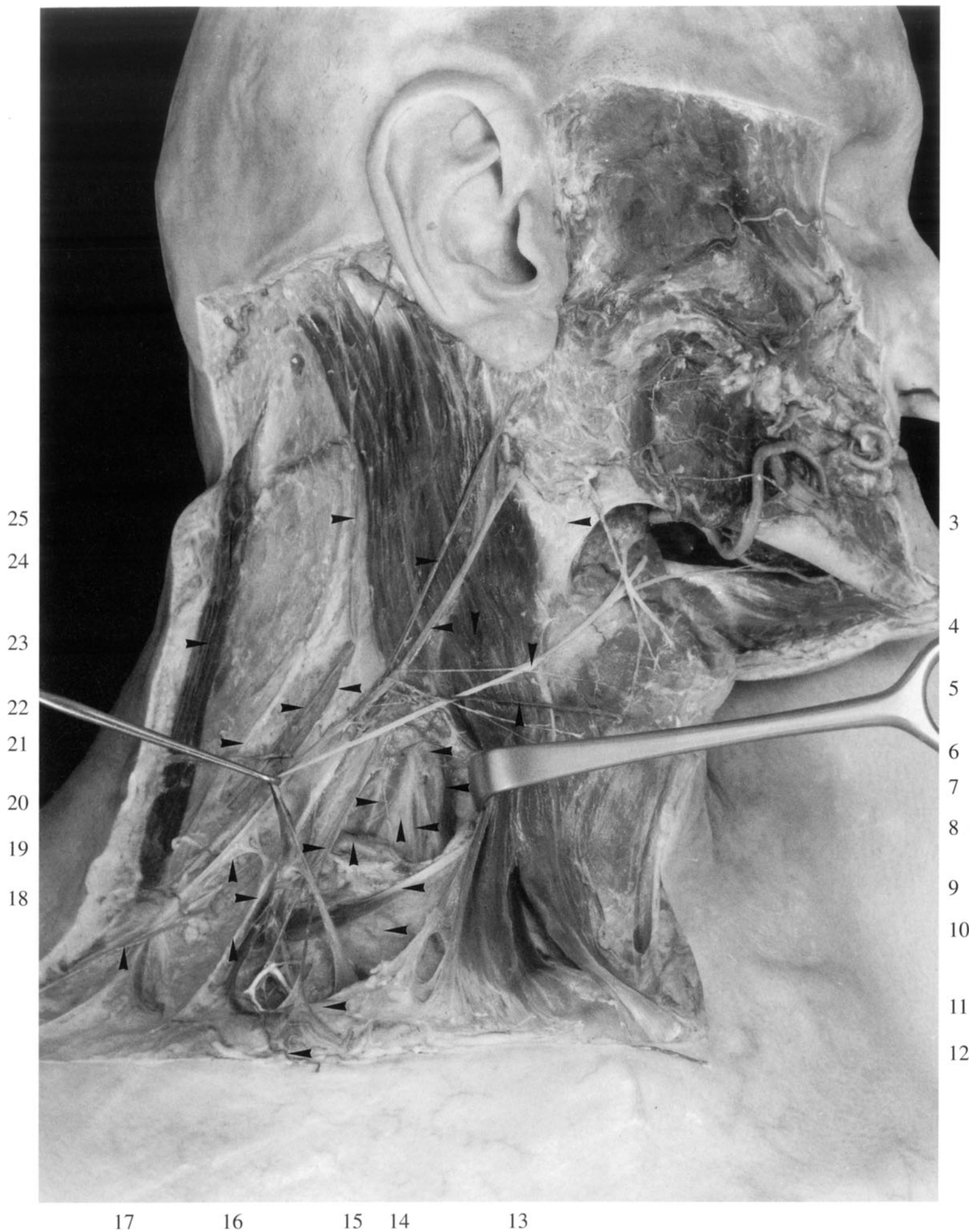


Figure 31**Lateral Cervical Region 2
Nerves**

- | | | | |
|----|---|----|--|
| 1 | Trapezius muscle | 22 | Clavicle |
| 2 | Splenius capitis muscle | 23 | Inferior thyroid artery |
| 3 | Accessory nerve | 24 | Scalenus anterior muscle |
| 4 | Sternocleidomastoid muscle | 25 | Brachial plexus |
| 5 | Longus capitis muscle
(covered by prevertebral layer
of deep cervical fascia) | 26 | Scalenus medius muscle |
| 6 | Great auricular nerve (anterior branch) | 27 | Transverse cervical artery (superficial branch) |
| 7 | Transverse cervical nerve (superior branches) | 28 | Levator scapulae muscle
(covered by deep cervical fascia) |
| 8 | Third cervical nerve (anterior ramus) | 29 | Serratus anterior muscle (highest slip) |
| 9 | Ansa cervicalis (posterior root) | 30 | Long thoracic nerve |
| 10 | Transverse cervical nerve (inferior branch) | 31 | Long thoracic nerve
(muscular branch to highest slip
of serratus anterior) |
| 11 | Fourth cervical nerve (anterior ramus) | 32 | Dorsal scapular nerve |
| 12 | Internal jugular vein | 33 | Transverse cervical artery (deep branch) |
| 13 | Fifth cervical nerve (connecting branch to C4) | 34 | Muscular branch to scalenus medius muscle |
| 14 | Ansa cervicalis (posterior root) | 35 | Trapezius branch of cervical plexus from C4 |
| 15 | Carotid tubercle
(anterior tubercle of transverse process of C6) | 36 | Supraclavicular nerves |
| 16 | Ascending cervical artery | 37 | Trapezius branch of cervical plexus from C3 |
| 17 | Phrenic nerve | 38 | Muscular branch
of cervical plexus to levator scapulae muscle |
| 18 | Transverse cervical artery | 39 | Great auricular nerve (posterior branch) |
| 19 | Transverse cervical vein | 40 | Lesser occipital nerve |
| 20 | Omohyoid muscle (inferior belly) | | |
| 21 | Middle cervical fascia
(pretracheal layer of cervical fascia) | | |

1 2 3 4 5 6 7

40

39

38

37

36

35

34

33

32

31

30

29

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

28 27 26 25 24 23

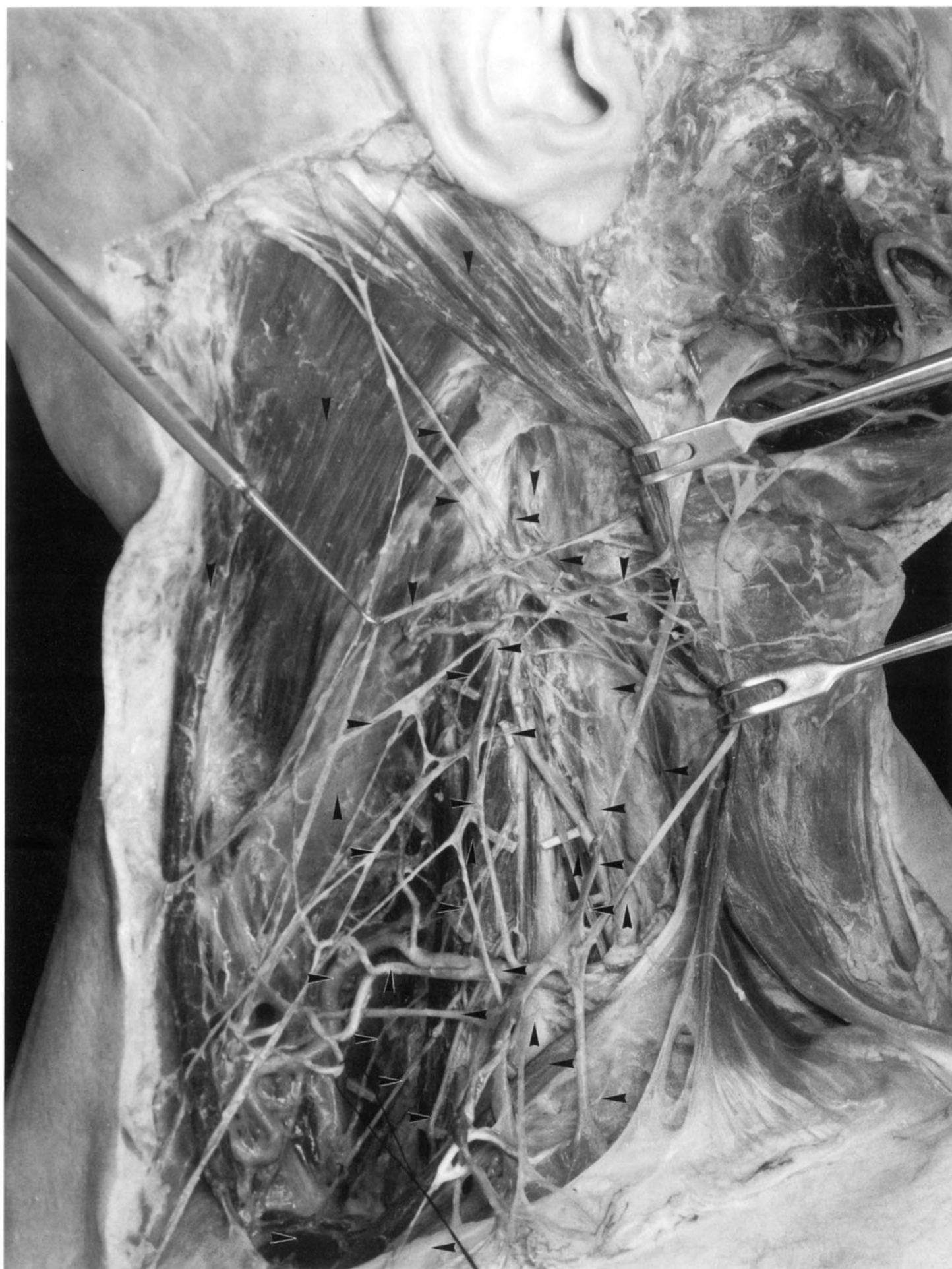


Figure 32**Lateral Cervical Region 3
Arteries**

- | | | | |
|----|--|----|---|
| 1 | Trapezius muscle | 23 | Scalenus medius muscle |
| 2 | Splenius capitis muscle | 24 | Long thoracic nerve |
| 3 | Trapezius branch of cervical plexus from C3 | 25 | Transverse cervical artery (superficial branch) |
| 4 | Accessory nerve | 26 | Dorsal scapular nerve |
| 5 | Great auricular nerve (anterior branch) | 27 | Serratus anterior muscle (highest slip) |
| 6 | Parotid gland (cervical lobe) | 28 | Omohyoid muscle (inferior belly) |
| 7 | Sternocleidomastoid muscle | 29 | Long thoracic nerve |
| 8 | Angular tract of superficial cervical fascia | | (branch to highest slip |
| 9 | Third cervical nerve (anterior ramus) | | of serratus anterior muscle) |
| 10 | Phrenic nerve (part of C4) | 30 | Scalenus posterior muscle |
| 11 | Fifth cervical nerve | 31 | Transverse cervical artery |
| | (anterior ramus, connection with C4) | | (superficial descending branch) |
| 12 | Supraclavicular nerves | 32 | Transverse cervical artery (deep branch) |
| 13 | Carotid tubercle (of CHASSAIGNAC) | 33 | Transverse cervical artery |
| 14 | Phrenic nerve and ascending cervical artery | | (superficial ascending branch) |
| 15 | Inferior thyroid artery | 34 | Trapezius branch of cervical plexus from C4 |
| 16 | Thyrocervical trunk | 35 | Levator scapulae muscle |
| 17 | Brachial plexus | | (covered by deep cervical fascia) |
| 18 | Scalenus anterior muscle | 36 | Muscular branch |
| 19 | Suprascapular nerve | | of cervical plexus to levator scapulae |
| 20 | Suprasternal nerve (of supraclavicular nerves) | 37 | Accessory nerve |
| 21 | Suprascapular artery | 38 | Great auricular nerve (posterior branch) |
| 22 | Transverse cervical artery | 39 | Lesser occipital nerve |

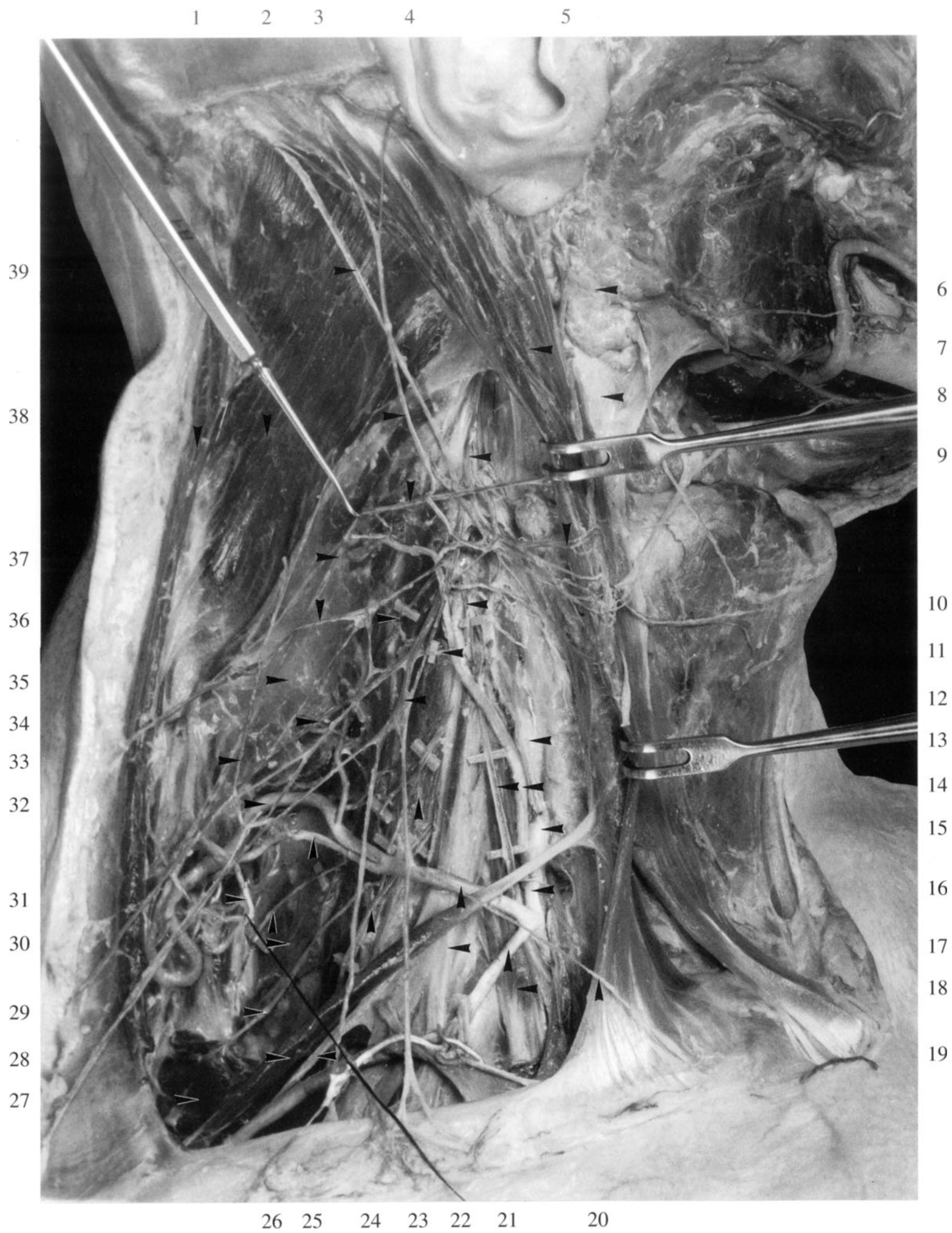


Figure 33 **Submandibular Triangle 1**
 Superficial Cervical Region 2

- | | | | |
|----|---|----|--|
| 1 | Parotid gland | 17 | Sternohyoid muscle |
| 2 | Parotid duct | | (covered by superficial cervical fascia) |
| 3 | Mandibular angle | 18 | Anterior jugular vein |
| 4 | Facial artery | 19 | Digastric muscle (anterior belly) |
| 5 | Fibrofatty layer (lateral to hyoglossus muscle) | 20 | Submental vein |
| 6 | Mylohyoid muscle | 21 | Digastric muscle |
| 7 | Submental artery | | (intermediate tendon with anchoring loop) |
| 8 | Transverse facial artery | 22 | Omohyoid muscle |
| 9 | Buccal fat pad | | (covered by superficial cervical fascia) |
| 10 | Facial nerve (buccal branch) | 23 | Transverse cervical nerve |
| 11 | Masseter muscle | 24 | Sternocleidomastoid muscle |
| 12 | Mandible | | (covered by superficial cervical fascia) |
| 13 | Submandibular gland | 25 | External jugular vein |
| 14 | Superficial ansa cervicalis | 26 | Attachment of roof of flat tunnel |
| 15 | Facial nerve (cervical branch) | 27 | Great auricular nerve (anterior branch) |
| 16 | Facial vein | 28 | Angular tract of superficial cervical fascia |
| | | 29 | Facial nerve (marginal mandibular branch) |



Figure 34**Submandibular Triangle 2**

- | | | | |
|----|---|----|--|
| 1 | Great auricular nerve (anterior branch) | 20 | Sternohyoid muscle |
| 2 | Superficial cervical lymph node | | (covered by superficial cervical fascia) |
| 3 | Parotid gland (deep part) | 21 | Digastric muscle (anterior belly) |
| 4 | Facial nerve (marginal mandibular branch) | 22 | Submandibular duct (of WHARTON) |
| 5 | Facial nerve (buccal branches) | 23 | Lingual artery |
| 6 | Submandibular lymph node | 24 | Submandibular gland |
| 7 | Submandibular ganglion | 25 | Submandibular lymph node |
| 8 | Lingual nerve | 26 | Facial vein |
| 9 | Mylohyoid nerve | 27 | Transverse cervical nerve |
| 10 | Submental artery | 28 | Sternocleidomastoid muscle |
| 11 | Mandible | | (covered by superficial cervical fascia) |
| 12 | Buccal fat pad | 29 | External jugular vein |
| 13 | Masseter muscle | 30 | Digastric muscle (intermediate tendon) |
| 14 | Anastomotic branch for buccal artery | 31 | Hypoglossal nerve with accompanying vein |
| 15 | Tonsillar branch | 32 | Superficial ansa cervicalis |
| 16 | Mylohyoid muscle | 33 | Facial artery |
| 17 | Sublingual gland | 34 | Angular tract of superficial cervical fascia |
| 18 | Hyoglossus muscle | 35 | Retromandibular vein |
| 19 | Omohyoid muscle | 36 | Facial nerve (cervical branch, resected) |
| | (covered by superficial cervical fascia) | | |



Figure 35 **Parotid-Masseter Region 1**
Platysma

- | | | | |
|----|---|----|--|
| 1 | Parotid fascia | 14 | Platysma |
| 2 | Parotid gland
(covered by thin portion of parotid fascia) | 15 | Platysma (short muscle bundle) |
| 3 | Accessory parotid gland
(covered by parotid and masseteric fascia) | 16 | Masseter muscle (covered by masseteric fascia) |
| 4 | Zygomaticus major muscle | 17 | Masseter muscle (covered by masseteric fascia) |
| 5 | Orbicularis oris muscle | 18 | Parotid gland (covered by parotid fascia) |
| 6 | Orbicularis oculi muscle (orbital part) | 19 | Cutaneous branch of sternocleidomastoid artery |
| 7 | Zygomaticus minor muscle | 20 | Cutaneous branch of transverse cervical artery |
| 8 | Buccal fat pad | 21 | Cutaneous branch of superior thyroid artery |
| 9 | Risorius muscle | 22 | Great auricular nerve (posterior branch) |
| 10 | Depressor labii inferioris muscle
(quadratus labii inferioris) | 23 | Great auricular nerve (anterior branch) |
| 11 | Cutaneous branch of facial artery | 24 | Platysma (short muscle bundle) |
| 12 | Depressor anguli oris muscle
(triangularis muscle) | 25 | Cutaneous branch of posterior auricular artery |
| 13 | Platysma (superficial muscle bundle) | 26 | Cutaneous branch of superficial temporal artery |
| | | 27 | Auricular branches
of superficial temporal artery |
| | | 28 | Cutaneous branch of superficial temporal artery |

1 2 3 4 5

28

27

26

25

24

23

22

21

6

7

8

9

10

11

20

19

18

17

16

15

14

13

12

Figure 36 **Parotid-Masseter Region 2**
Facial Nerve 1

- | | | | |
|----|--|----|--|
| 1 | Superficial temporal artery | 16 | Facial artery |
| 2 | Temporal fascia (superficial layer) | 17 | Buccal fat pad |
| 3 | Facial nerve (zygomatic branches) | 18 | Facial nerve (buccal branch) |
| 4 | Parotid duct | 19 | Facial nerve
(buccal branch and anastomosis
with a zygomatic branch) |
| 5 | Accessory parotid gland | 20 | Facial nerve (buccal branch) |
| 6 | Parotid duct | 21 | Facial nerve (marginal mandibular branch) |
| 7 | Orbicularis oculi muscle (orbital part) | 22 | Facial nerve (cervical branch) |
| 8 | Facial nerve (temporal branches) | 23 | Transverse cervical nerve |
| 9 | Zygomaticus major muscle | 24 | Sternocleidomastoid muscle
(covered by superficial cervical fascia) |
| 10 | Facial vein | 25 | Great auricular nerve (posterior branch) |
| 11 | Risorius muscle | 26 | Great auricular nerve (anterior branch) |
| 12 | Depressor anguli oris muscle
(triangularis muscle) | 27 | Retromandibular vein |
| 13 | Platysma | 28 | Masseter muscle |
| 14 | Subcutaneous tissue | 29 | Parotid gland |
| 15 | Anterior jugular vein
(with cutaneous branches
of superior thyroid artery) | 30 | Auriculotemporal nerve |
| | | 31 | Superficial temporal vein |

1 2 3 4 5 6

31

30

29

28

27

26

25

24

7

8

9

10

11

12

13

14

15

23

22

21

20

19

18

17

16

Figure 37 **Parotid-Masseter Region 3**
Facial Nerve 2

- | | | | |
|----|---|----|--|
| 1 | Auriculotemporal nerve | 18 | Facial artery |
| 2 | Middle temporal vein | 19 | Buccal fat pad |
| 3 | Facial nerve (buccal branch) | 20 | Facial vein |
| 4 | Parotid duct with transverse facial artery | 21 | Masseter muscle |
| 5 | Facial nerve (zygomatic branches) | 22 | Facial nerve
(buccal branch of marginal mandibular branch) |
| 6 | Accessory parotid gland | 23 | Facial nerve (marginal mandibular branch) |
| 7 | Masseter muscle (tendon of origin on zygoma) | 24 | Retromandibular vein |
| 8 | Parotid duct | 25 | Facial nerve (cervical branch) |
| 9 | Zygomatico-orbital artery | 26 | Anterior jugular vein |
| 10 | Facial nerve (temporal branches) | 27 | Sternocleidomastoid muscle
(covered by superficial cervical fascia) |
| 11 | Orbicularis oculi muscle (orbital part) | 28 | Facial nerve
(ascending cervical branch, resected) |
| 12 | Facial nerve
(anastomoses of peripheral branches) | 29 | Great auricular nerve (anterior branch) |
| 13 | Zygomaticus major muscle | 30 | Facial nerve
(buccal branch and anastomosis
with marginal mandibular branch) |
| 14 | Superior labial artery | 31 | Parotid gland |
| 15 | Risorius muscle (cut edge) | 32 | Superficial temporal vein |
| 16 | Depressor anguli oris muscle
(triangularis muscle) | 33 | Superficial temporal artery |
| 17 | Facial nerve
(branch to mimetic muscles
from cervical branch) | | |

1 2 3 4 5 6 7 8

33

32

31

30

29

28

27

26

9

10

11

12

13

14

15

16

17

25

24

23

22

21

20

19

18

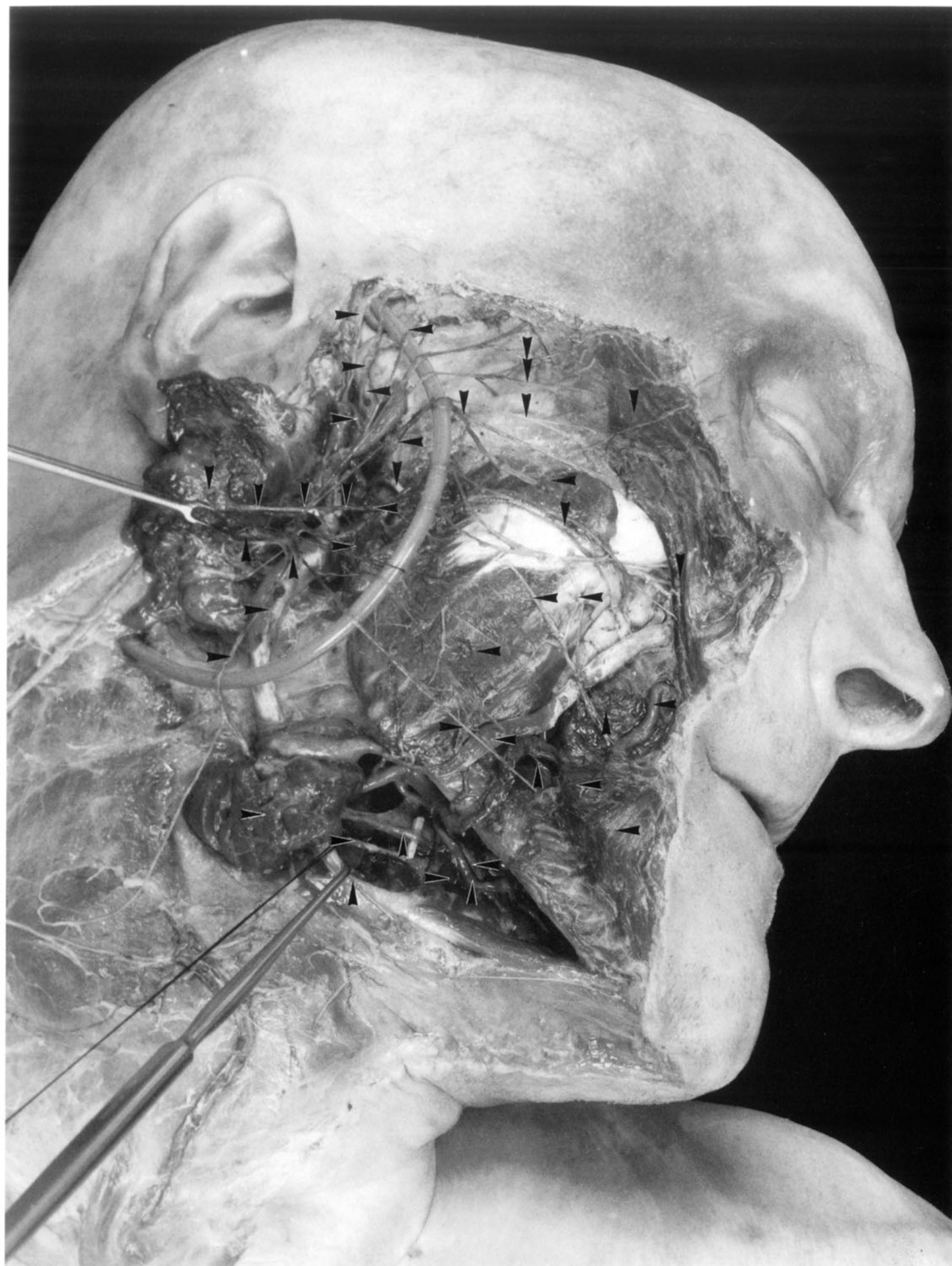
Figure 38 **Parotid-Masseter Region 4**
Facial Nerve 3

- | | |
|---|--|
| 1 Parotid gland (superficial part) | 21 Depressor anguli oris muscle |
| 2 Nerve bundle supplying parotid gland | (triangularis muscle) |
| 3 Facial nerve (superior or temporofacial branch) | 22 Mylohyoid muscle |
| 4 Communicating branch to facial nerve | 23 Buccinator muscle |
| 5 Transverse facial artery | 24 Facial nerve |
| 6 Facial nerve (zygomatic branch) | (marginal mandibular branch, deep branch) |
| 7 Facial nerve (branches to orbicularis oculi) | 25 Submental artery |
| 8 Parotid duct (of STENO) | 26 Submandibular duct (of WHARTON) |
| 9 Orbicularis oculi muscle (orbital part) | 27 Digastric muscle (intermediate tendon) |
| 10 Zygomaticus major muscle | 28 Facial nerve (inferior or cervicofacial branch) |
| 11 Facial nerve (temporal branch to anterior | 29 Great auricular nerve |
| and superior auricular | (anastomosis with facial nerve) |
| and temporoparietal muscles) | 30 Mylohyoid muscle |
| 12 Superficial temporal artery | 31 Hypoglossal nerve |
| 13 Communicating branch to facial nerve | 32 Submandibular gland |
| 14 Accessory parotid gland | 33 Facial nerve (marginal mandibular branch) |
| 15 Masseteric branch | 34 Facial nerve (cervical branch) |
| 16 Facial nerve (buccal branches) | 35 Retromandibular vein |
| 17 Masseter muscle | 36 Parotid gland (deep part) |
| 18 Facial artery | 37 Anterior auricular branch |
| 19 Facial vein | 38 Auriculotemporal nerve |
| 20 Risorius muscle (resected) | 39 Superficial temporal vein (collapsed) |

1 2 3 4 5 6 7 8 9 10

39
38
37
36
35
34
33
32
31
30

11
12
13
14
15
16
17
18
19
20
21
22



29 28 27 26 25 24 23

Figure 39**Parotid-Masseter Region 5
Parotid Gland and Vessels**

- | | | | |
|----|---|----|---|
| 1 | Parotid gland (superficial part) | 23 | Masseter muscle |
| 2 | Cartilage of acoustic meatus | 24 | Parotid branch |
| 3 | Parotid branch of superficial temporal artery | 25 | Glandular vein (for deep part of parotid gland) |
| 4 | Transverse facial artery | 26 | Parotid branch of transverse facial artery |
| 5 | Accessory middle temporal artery (variant) | 27 | Digastric muscle (posterior belly) |
| 6 | Facial nerve (zygomatic branch) | 28 | Occipital artery |
| 7 | Transverse facial artery | 29 | Hyoid bone (greater cornu) |
| 8 | Buccal fat pad | 30 | Carotid bifurcation |
| 9 | Facial artery (lateral nasal branch) | 31 | Hypoglossal nerve |
| 10 | Zygomatico-orbital artery | 32 | Pharyngeal vein
(deep maxillary venous drainage
into internal jugular vein) |
| 11 | Accessory parotid gland | 33 | Accessory nerve |
| 12 | Facial nerve (superior or temporofacial branch) | 34 | Posterior auricular artery
with parotid branches and vein |
| 13 | Facial nerve (inferior or cervicofacial branch) | 35 | Facial nerve (main trunk) |
| 14 | Parotid gland (deep part) | 36 | Parotid branch of superficial temporal artery |
| 15 | External carotid artery | 37 | Superficial temporal artery and vein |
| 16 | Facial artery (masseteric and glandular branch) | 38 | Auriculotemporal nerve |
| 17 | Facial artery | 39 | Superficial temporal artery
(anterior auricular branches) |
| 18 | Submandibular gland | 40 | Superficial temporal artery |
| 19 | Mylohyoid muscle | | |
| 20 | Depressor anguli oris muscle
(triangularis muscle) | | |
| 21 | Facial artery (inferior labial artery) | | |
| 22 | Submental artery | | |

1 2 3 4 5 6 7 8 9

40
39
38
37
36
35
34
33
32
31
30
29

10
11
12
13
14
15
16
17
18
19



28 27 26 25 24 23 22 21 20

Figure 40**Lateral Facial Region
Retromandibular Fossa**

- | | | | |
|----|---|----|--|
| 1 | Posterior auricular artery (auricular branch) | 24 | Facial nerve (buccal branch on masseter muscle) |
| 2 | Parotid branch of posterior auricular artery | 25 | Facial nerve (marginal mandibular branch) |
| 3 | Cartilage of acoustic meatus | 26 | Thickened portion of masseteric fascia (fibrous plate) |
| 4 | Styloid process | 27 | Styloglossus muscle |
| 5 | Parotid branch of superficial temporal artery | 28 | Facial nerve (upper main branch [temporofacial branch]) |
| 6 | Accessory middle temporal artery (variant) | 29 | External carotid artery |
| 7 | Temporal fascia (superficial layer) | 30 | Transverse process of atlas |
| 8 | Facial nerve (zygomatic branches) | 31 | Occipital artery |
| 9 | Transverse facial artery | 32 | Digastric muscle (parotid belly) and stylohyoid muscle |
| 10 | Buccal fat pad | 33 | Facial nerve (lower main branch [cervicofacial branch] and posterior auricular vein) |
| 11 | Parotid duct (of STENO) | 34 | Posterior auricular artery |
| 12 | Zygomatico-orbital artery | 35 | Posterior auricular artery (occipital branch) |
| 13 | Auriculotemporal nerve | 36 | Facial nerve (posterior auricular nerve) |
| 14 | Facial nerve (temporal branches) | 37 | Posterior auricular artery (auricular branch) |
| 15 | Masseteric artery | 38 | Lamina tragi |
| 16 | Masseteric branch of transverse facial artery | 39 | Anterior auricular artery |
| 17 | Facial nerve | 40 | Superficial temporal artery |
| 18 | Stylomandibular ligament | | |
| 19 | Stylopharyngeus muscle | | |
| 20 | Ascending palatine branch of facial artery | | |
| 21 | Masseteric branches of facial artery | | |
| 22 | Facial nerve (cervical branch) | | |
| 23 | Facial artery | | |

1 2 3 4 5 6 7 8 9 10 11

40

39

38

37

36

35

34

33

32

31

12

13

14

15

16

17

18

19

20

21

22

30

29

28

27

26

25

24

23

Figure 41 **Temporal Region 1**
and Lateral Facial Region 1

- | | | | |
|----|---|----|--|
| 1 | Auricularis superior muscle | 18 | Accessory parotid gland |
| 2 | Auricularis superior muscle | 19 | Parotid duct (of STENO) |
| 3 | Zygomatic arch | 20 | Masseter muscle (deep part) |
| 4 | Temporal fascia (cut edge of superficial layer) | 21 | Styloid process (inferior end) |
| 5 | Zygomatico-orbital artery | 22 | Parotid branch of posterior auricular artery |
| 6 | Orbicularis oculi muscle (orbital part) | 23 | Sternocleidomastoid muscle |
| 7 | Occipitofrontalis muscle (frontal belly) | 24 | Digastric muscle (intermediate tendon) |
| 8 | Auricularis anterior muscle (resected) | 25 | Mandibular ramus |
| 9 | Temporal fascia (deep layer) | 26 | Posterior auricular artery |
| 10 | Middle temporal artery | 27 | Retromandibular vein |
| 11 | Temporomandibular joint | 28 | Superficial temporal artery |
| 12 | Transverse facial artery | 29 | Auriculotemporal nerve |
| 13 | Lateral nasal branch | 30 | Anterior auricular branch |
| 14 | Masseter muscle (superficial part) | 31 | Anterior auricular branch |
| 15 | Facial artery | 32 | Superficial temporal artery |
| 16 | Inferior labial artery | 33 | Temporoparietalis muscle (cut edge) |
| 17 | Buccal fat pad (of BICHAT) | | |

1 2 3 4 5 6

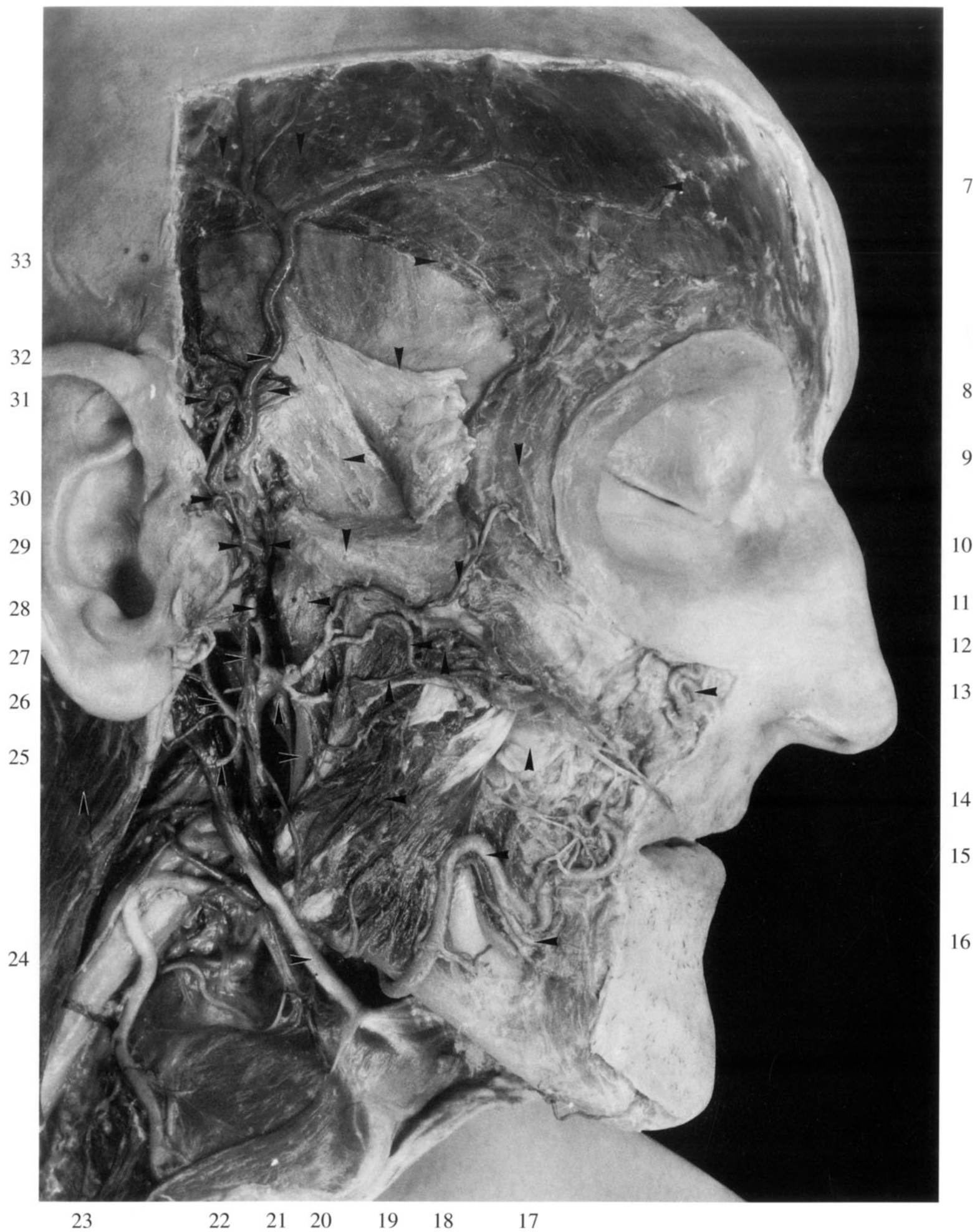


Figure 42

**Temporal Region 2
and Lateral Facial Region 2**

- | | | | |
|----|---|----|--|
| 1 | Zygomatic process of temporal bone
(with articular tubercle) | 18 | Buccotemporal fascia |
| 2 | Superficial temporal artery (frontal branch) | 19 | Coronoid process (with temporalis tendon) |
| 3 | Temporal fascia | 20 | Condylar process |
| 4 | Occipitofrontalis muscle (frontal belly)
(frontalis muscle) | 21 | Digastric muscle
(intermediate tendon
with fibrous anchoring slip) |
| 5 | Temporalis muscle | 22 | Facial artery |
| 6 | Buccal fat pad (temporal process) | 23 | Anastomotic branch for buccal artery |
| 7 | Zygoma (cut surface) | 24 | Oblique line of mandible |
| 8 | Buccal fat pad (orbital process) | 25 | Buccinator muscle |
| 9 | Maxillary tuberosity | 26 | Masseter muscle |
| 10 | Facial artery (lateral nasal branch) | 27 | Masseteric nerve |
| 11 | Parotid duct (of STENO) | 28 | Temporomandibular joint (lateral ligament) |
| 12 | Facial artery (superior labial branch) | 29 | Lamina tragi |
| 13 | Buccal nerve | 30 | Auriculotemporal nerve |
| 14 | Facial artery (inferior labial branch) | 31 | Superficial temporal artery
(anterior auricular branch) |
| 15 | Depressor anguli oris muscle
(triangularis muscle) | 32 | Superficial temporal artery |
| 16 | Superior oral coronary artery | 33 | Superficial temporal artery (parietal branch) |
| 17 | Buccal fat pad ("masseter plug" of FORSTER) | | |

1 2 3

33

4

32

5

31

6

30

7

29

8

28

9

27

10

26

11

25

12

24

13

23

14

22

15

21

20

19

18

17

16

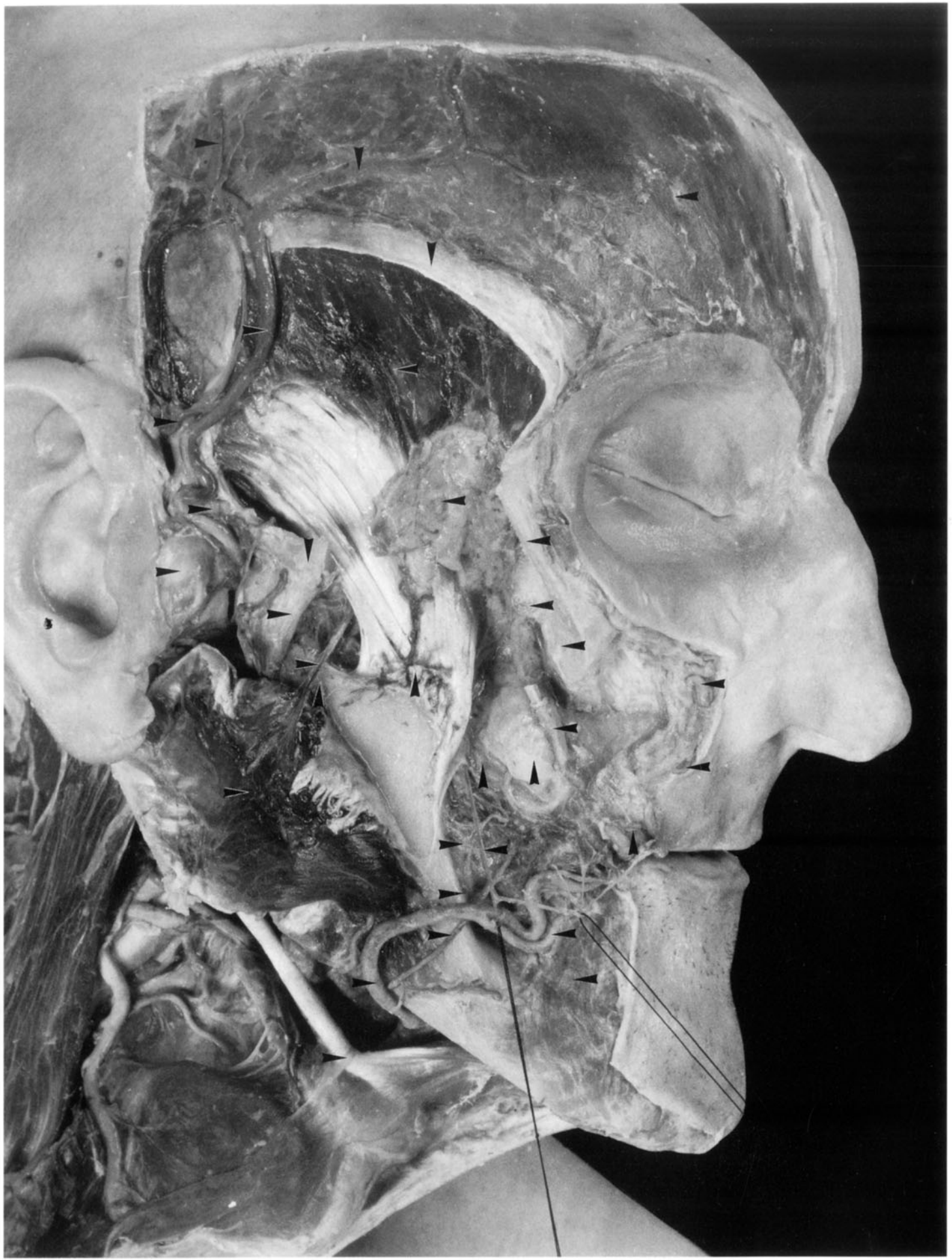


Figure 43**Infratemporal Fossa 1**

- | | | | |
|----|--|----|---|
| 1 | Anterior auricular branches | 19 | Zygoma (cut surface) |
| 2 | Temporomandibular joint
(with joint capsule and lateral ligament) | 20 | Buccal fat pad (masseter plug of FORSTER) |
| 3 | Zygomatic process of temporal bone
and articular tubercle | 21 | Buccinator muscle |
| 4 | Deep temporal nerve (middle) | 22 | Buccal fat pad (pterygoid process) |
| 5 | Maxillary artery | 23 | Mylohyoid nerve |
| 6 | Temporal fascia | 24 | Maxillary artery |
| 7 | Temporalis muscle | 25 | Stylohyoid muscle |
| 8 | Buccal fat pad (temporal process) | 26 | Masseter muscle |
| 9 | Anterior deep temporal artery | 27 | Sternocleidomastoid muscle |
| 10 | Deep temporal nerve (anterior) | 28 | Digastric muscle (posterior belly) |
| 11 | Buccal artery | 29 | Styloid process with stylomandibular ligament |
| 12 | Inferior alveolar nerve | 30 | External carotid artery |
| 13 | Lingual nerve | 31 | Posterior temporal artery |
| 14 | Inferior alveolar artery with mylohyoid branch | 32 | Neck of mandible |
| 15 | Buccal nerve | 33 | Lateral pterygoid muscle
(inferior head with pterygoid branches) |
| 16 | Anastomosis between buccal artery
and facial artery | 34 | Deep temporal nerve (posterior)
with masseteric nerve |
| 17 | Inferior labial artery | 35 | Auriculotemporal nerve |
| 18 | Facial artery | 36 | Superficial temporal artery |

1 2 3 4 5 6

36

7

35

8

34

9

33

10

32

11

31

12

30

13

29

14

28

15

27

16

26

17

18

25 24 23 22 21 20 19

Figure 44**Infratemporal Fossa 2**

- | | | | |
|----|---|----|---|
| 1 | Maxillary artery | 16 | Body of mandible (inferior border) |
| 2 | Spine of sphenoid bone | 17 | Depressor anguli oris muscle
(triangularis muscle) |
| 3 | Tensor veli palatini muscle with
[pterygospinal foramen] | 18 | Zygomatic bone (cut surface) |
| 4 | Pterygoid process (lateral plate) | 19 | Maxillary tuberosity |
| 5 | Pterygopalatine foramen | 20 | Lateral pterygoid muscle (inferior belly) |
| 6 | Temporal fascia | 21 | Tendinous plate on deep surface
of medial pterygoid muscle |
| 7 | Temporalis muscle | 22 | External carotid artery |
| 8 | Buccal fat pad (temporal process) | 23 | Digastric muscle (posterior belly) |
| 9 | Infratemporal crest
(with tendinous origin of superior belly
of lateral pterygoid) | 24 | Sternocleidomastoid muscle |
| 10 | Foramen ovale (anterior margin) | 25 | Stylohyoid muscle |
| 11 | Pterygospinous process of lateral pterygoid plate | 26 | Styloid process and stylomandibular ligament |
| 12 | Medial pterygoid muscle
(portion arising from outer surface
of lateral pterygoid plate) | 27 | Sphenomandibular ligament |
| 13 | Buccinator muscle | 28 | Tensor veli palatini muscle |
| 14 | Masseter muscle | 29 | Pterygospinal ligament |
| 15 | Facial artery | 30 | Articular disk of temporomandibular joint |
| | | 31 | Infratemporal crest |
| | | 32 | Zygomatic process of temporal bone |
| | | 33 | Superficial temporal artery |

1 2 3 4 5

33

32

31

30

29

28

27

26

25

6

7

8

9

10

11

12

13

14

15

16

24

23

22

21

20

19

18

17

Figure 45**Infratemporal Fossa 3
Nerves and Vessels**

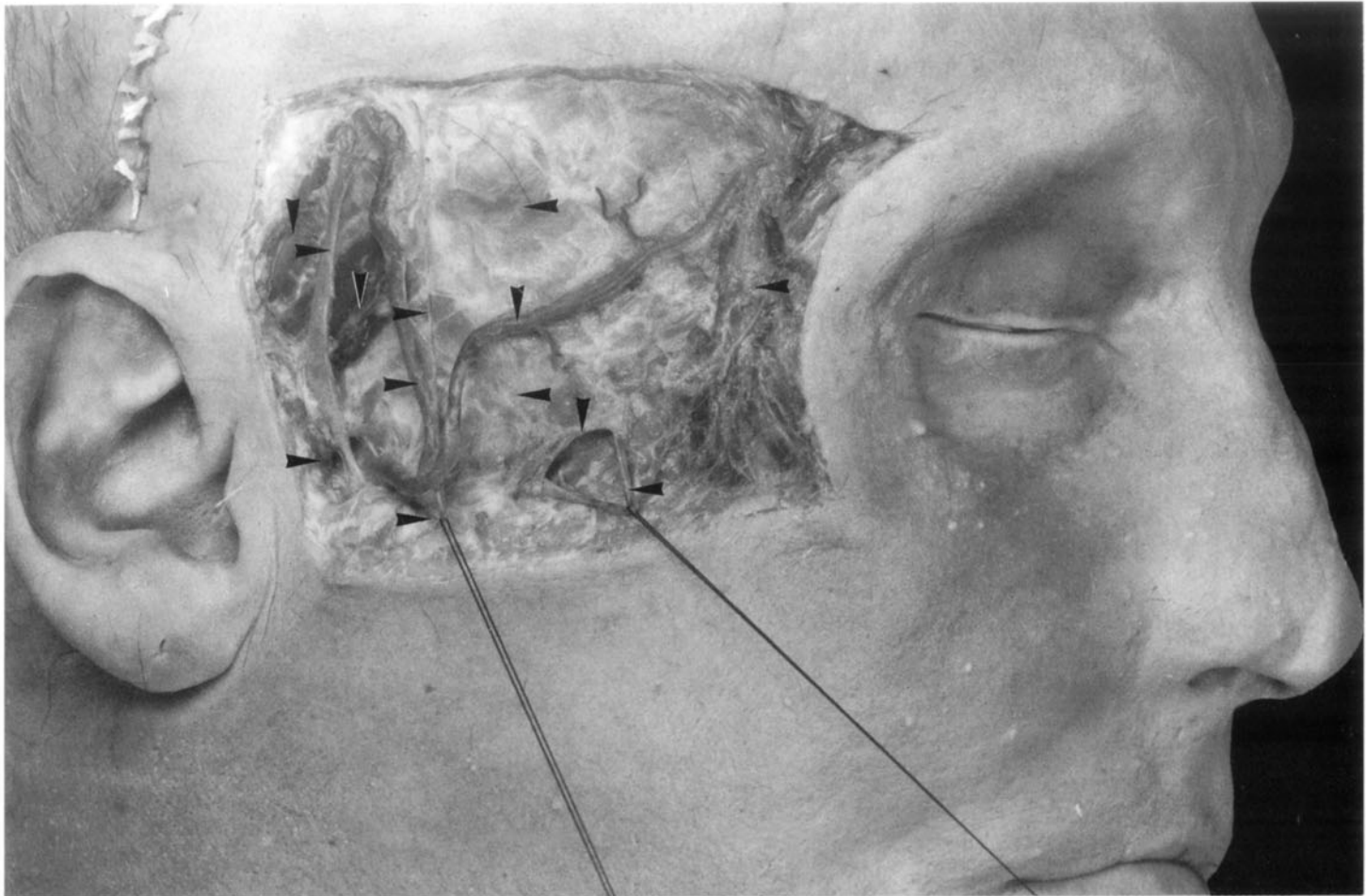
- | | | | |
|----|---|----|---|
| 1 | Anterior auricular branches | 22 | Deep temporal nerve (anterior) |
| 2 | Auriculotemporal nerve | 23 | Tensor veli palatini muscle
(pterygospinous foramen) |
| 3 | Spine of sphenoid bone (angular spine) | 24 | Middle meningeal artery and pterygoid branch
of maxillary artery |
| 4 | Posterior temporal artery | 25 | Maxillary artery |
| 5 | Innominate ligament (of HYRTL) | 26 | Deep auricular artery |
| 6 | Anterior deep temporal artery | 27 | Transverse facial artery (resected) |
| 7 | Posterior superior alveolar artery and nerve | 28 | Posterior auricular artery |
| 8 | Temporalis muscle | 29 | Stylohyoid muscle |
| 9 | Buccal fat pad (temporal process) | 30 | Digastric muscle (posterior belly) |
| 10 | Deep temporal nerve (middle) | 31 | Stylomandibular ligament |
| 11 | Masseteric nerve | 32 | External carotid artery |
| 12 | Infraorbital artery | 33 | Sphenomandibular ligament |
| 13 | Medial pterygoid nerve | 34 | Styloid process |
| 14 | Buccal artery | 35 | Chorda tympani on pterygospinal ligament |
| 15 | Chorda tympani | 36 | Anterior tympanic artery |
| 16 | Inferior alveolar nerve | 37 | Articular disk of temporomandibular joint |
| 17 | Lingual nerve | 38 | Zygomatic process of temporal bone |
| 18 | Inferior alveolar nerve and artery
with mylohyoid branch | 39 | Auriculotemporal nerve |
| 19 | Buccal nerve | 40 | Superficial temporal artery |
| 20 | Zygomatic bone (cut surface) | | |
| 21 | Descending palatine artery | | |



- | | |
|--|---|
| 1 Auricularis superior muscle | 16 Temporoparietalis muscle |
| 2 Auricularis anterior muscle | (covered by deep layer of stratum subcutaneum) |
| 3 Superficial temporal artery (frontal branch) | 17 Superficial temporal artery (frontal branch) |
| 4 Deep layer of stratum subcutaneum (cut edge) | 18 Superficial temporal artery |
| 5 Temporoparietalis muscle | 19 Auricularis superior muscle |
| (covered by deep layer of stratum subcutaneum) | 20 Posterior temporal branch of facial nerve |
| 6 Orbicularis oculi muscle (orbital part) | 21 Deep layer of stratum subcutaneum (cut edge) |
| 7 Deep layer of stratum subcutaneum | 22 Superficial temporal vein |
| 8 Anterior temporal branch of facial nerve | 23 Auricularis anterior muscle |
| 9 Middle temporal vein | with muscular branch |
| 10 Muscular branch to temporoparietalis muscle | 24 Muscular branch to auricularis superior muscle |
| 11 Temporal fascia (superficial layer) | 25 Superficial temporal artery (parietal branch) |
| 12 Orbicularis oculi muscle (orbital part) | 26 Posterior temporal branch of facial nerve |
| 13 Muscular branch to temporoparietalis muscle | 27 Anterior auricular artery |
| 14 Anterior temporal branch of facial nerve | 28 Superficial temporal artery (parietal branch) |
| 15 Muscular branch to orbicularis oculi muscle | 29 Muscular branch to auricularis superior muscle |
| | 30 Superficial temporal vein |

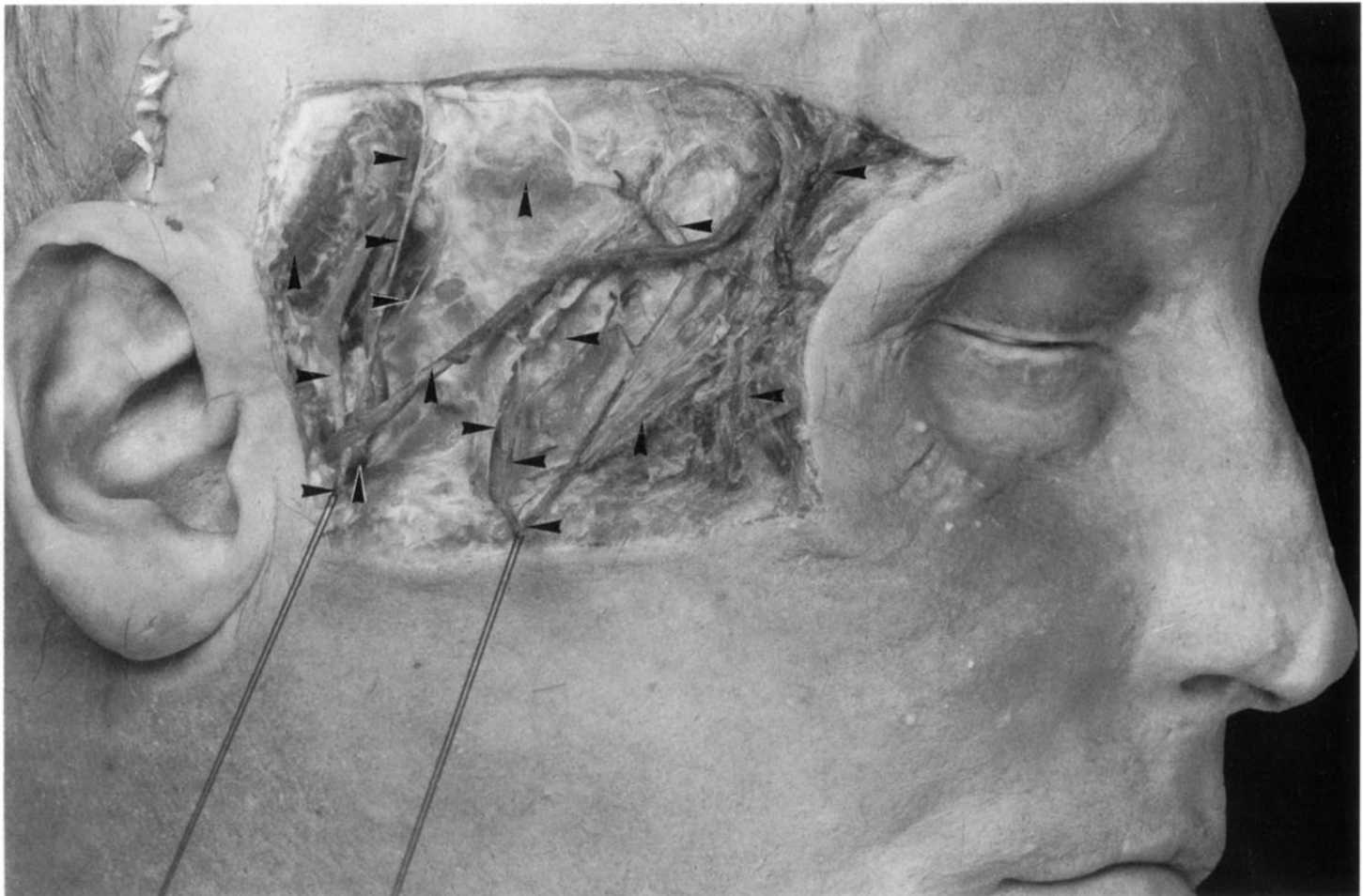
1 2 3 4

30
29
28
27
26



5
6
7
8

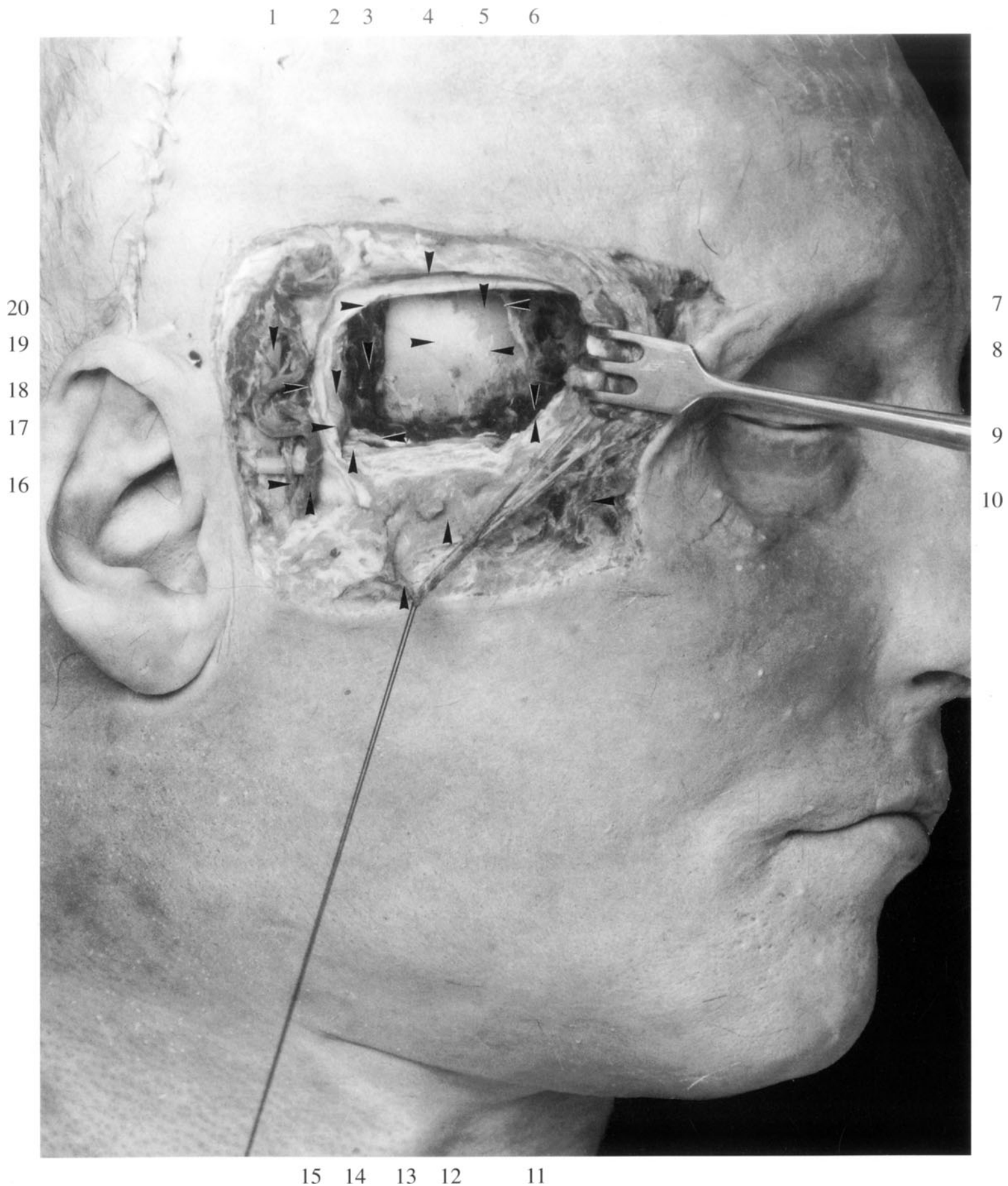
25
24
23
22
21
20



9
10
11
12
13
14

19 18 17 16 15

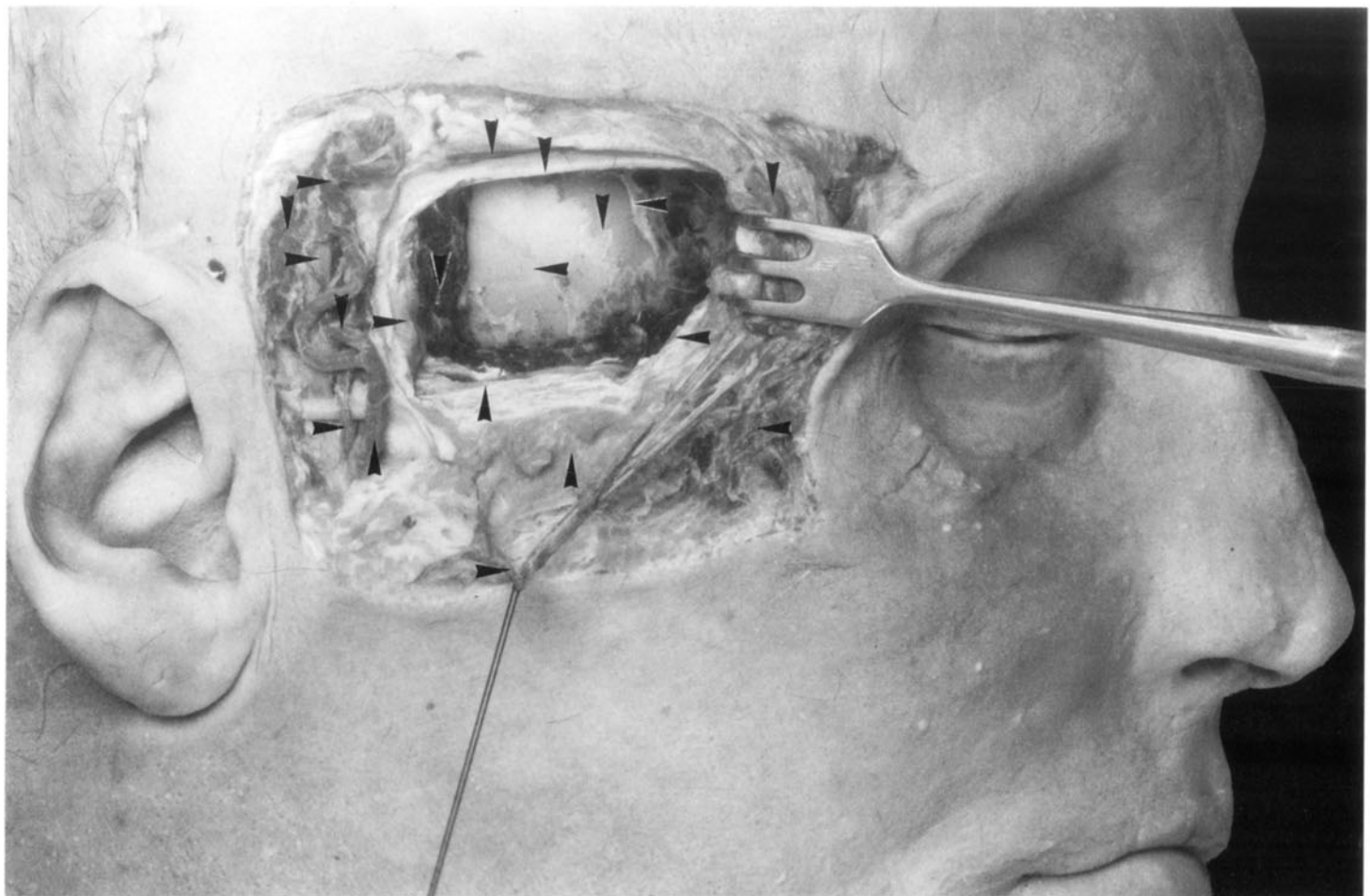
- | | | | |
|----|---|----|---|
| 1 | Superficial temporal vein | 11 | Temporal fascia (superficial layer) |
| 2 | Fat pad between superficial
and deep layers of temporal fascia | 12 | Zygomatic arch |
| 3 | Temporalis muscle (cut edge) | 13 | Facial nerve (temporal branch) |
| 4 | Temporoparietalis muscle (cut edge) | 14 | Fat pad between superficial
and deep layers of temporal fascia |
| 5 | Sphenoid bone (greater wing, temporal surface) | 15 | Superficial temporal artery |
| 6 | Temporalis muscle (cut edge) | 16 | Auriculotemporal nerve |
| 7 | Pericranium (cut edge) | 17 | Temporal fascia (superficial layer) |
| 8 | Sphenosquamous suture | 18 | Auricularis anterior muscle (cut edge) |
| 9 | Temporalis muscle (tendinous expansion) | 19 | Temporal bone (squamous part) |
| 10 | Orbicularis oculi muscle | 20 | Temporal fascia |



- | | |
|--|--|
| 1 Auricularis superior muscle | 17 Anterior deep temporal artery |
| 2 Superficial temporal artery
(frontal branch, resected) | 18 Posterior temporal artery |
| 3 Temporalis muscle (cut surface) | 19 Temporalis muscle (cut surface) |
| 4 Temporoparietalis muscle (cut surface) | 20 Superficial temporal artery |
| 5 Temporal fascia | 21 Superficial temporal vein |
| 6 Sphenosquamous suture | 22 Facial nerve (temporal branch) |
| 7 Superficial temporal artery
(frontal branch, resected) | 23 Zygomatic arch |
| 8 Pericranium (cut edge) | 24 Auriculotemporal nerve |
| 9 Temporal bone (squamous part) | 25 Cranial dura mater |
| 10 Temporal fascia (superficial layer, cut edge) | 26 Temporal bone (squamous part, cut surface) |
| 11 Orbicularis oculi muscle (orbital part) | 27 Middle meningeal artery (parietal branch) |
| 12 Deep layer of stratum subcutaneum (cut edge) | 28 Temporoparietalis muscle (cut surface) |
| 13 Middle meningeal artery (frontal branch) | 29 Facial nerve (temporal branch) |
| 14 Middle meningeal artery
(trunk of frontal and parietal branches) | 30 Auriculotemporal nerve |
| 15 Middle meningeal artery (orbital branch) | 31 Fat pad between superficial
and deep layers of temporal fascia |
| 16 Orbicularis oculi muscle (orbital part) | 32 Superficial temporal vein |
| | 33 Superficial temporal artery (parietal branch) |

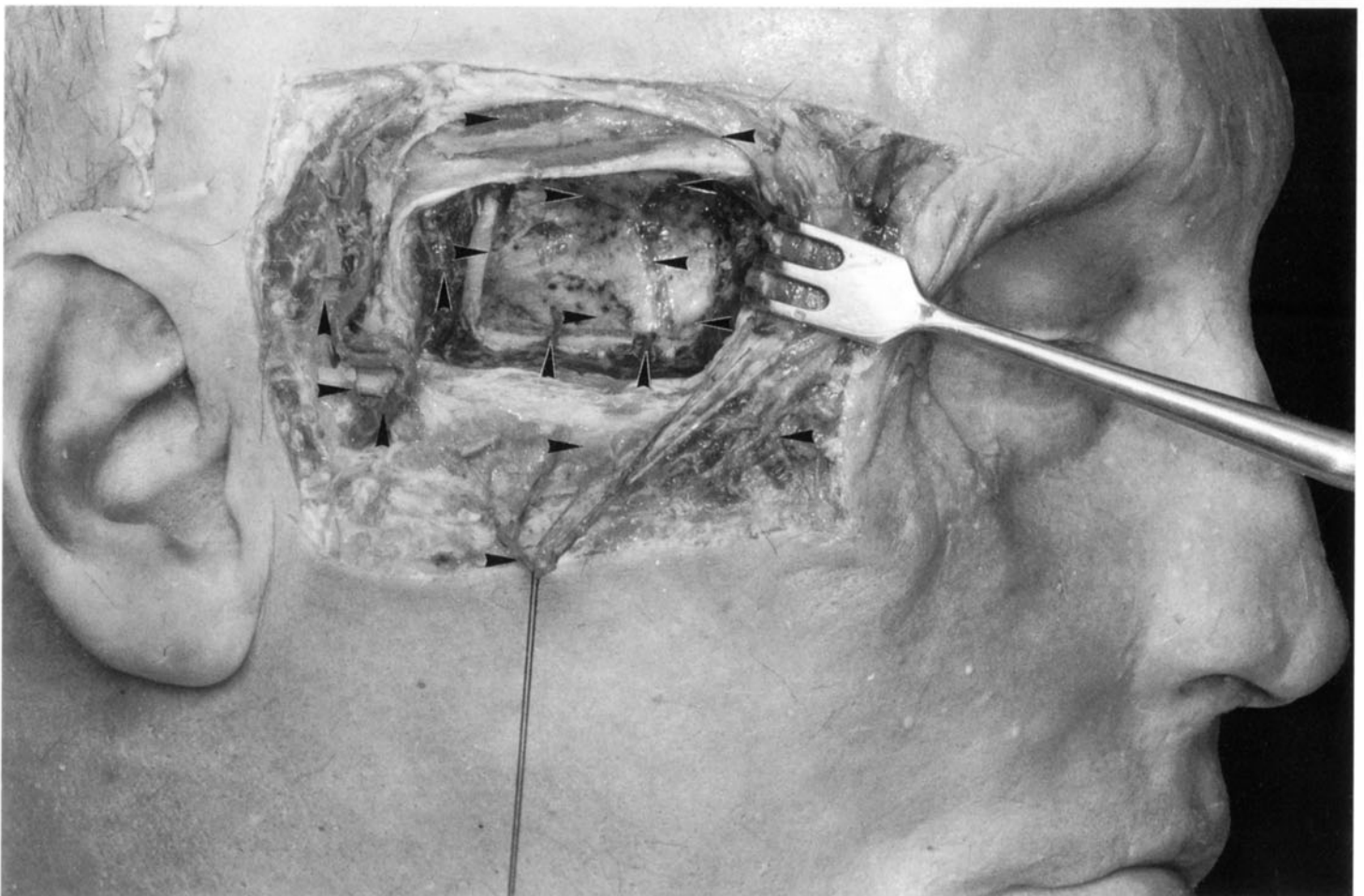
1 2 3 4 5 6 7

33
32
31
30
29



8
9
10
11

28
27
26
25
24
23
22



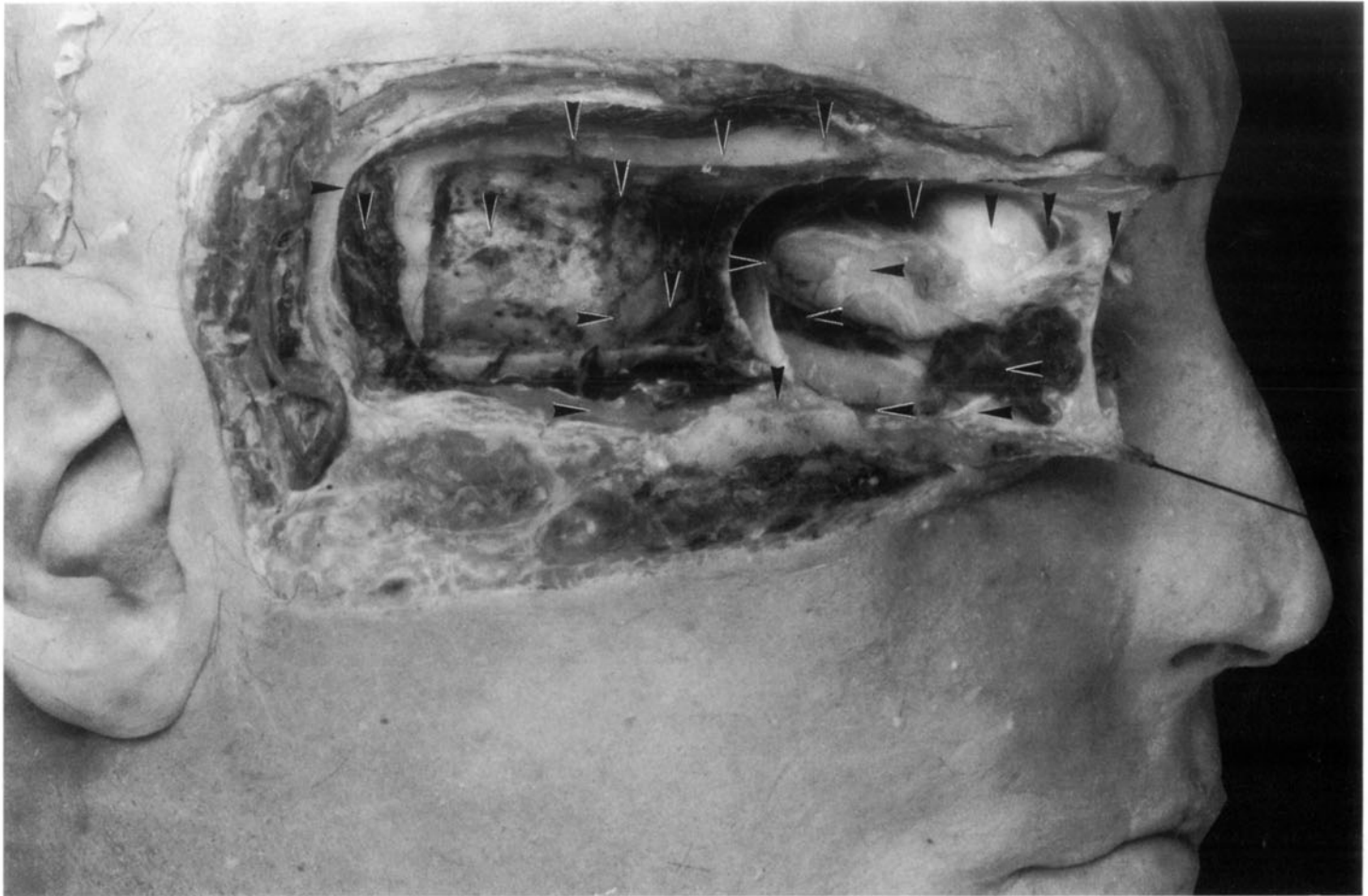
12
13
14
15
16

21 20 19 18 17

- | | | | |
|----|--|----|---|
| 1 | Temporalis muscle (cut surface) | 21 | Lacrimal gland (orbital part) |
| 2 | Cranial dura mater | 22 | Superior rectus muscle with muscle sheath |
| 3 | Sphenosquamous suture | 23 | Fascial slip from lateral rectus muscle |
| 4 | Middle meningeal artery (frontal branch) | 24 | Communicating branch of lacrimal nerve with zygomatic nerve |
| 5 | Middle meningeal artery (orbital branch) | 25 | Lateral rectus muscle and posterior ciliary arteries |
| 6 | Sphenoid bone (greater wing, temporal surface) | 26 | Zygomatic bone (cut surface) |
| 7 | Zygomatic bone (cut surface) | 27 | Middle meningeal artery (orbital branch) |
| 8 | Sphenofrontal suture | 28 | Middle meningeal artery |
| 9 | Superior rectus muscle | 29 | Middle meningeal artery (parietal branch) |
| 10 | Eyeball
(covered by fascial sheath of TENON's capsule) | 30 | Temporal fascia (deep layer) |
| 11 | Levator palpebrae superioris muscle | 31 | Temporalis muscle (cut surface) |
| 12 | Periorbita at junction with orbital septum | 32 | Lacrimal branch of infraorbital artery (variant) |
| 13 | Orbital fat | 33 | Lacrimal artery and nerve |
| 14 | Lateral rectus muscle | 34 | Optic nerve with apposing ciliary nerves |
| 15 | Lacrimal gland (orbital part) | 35 | Superior ophthalmic vein |
| 16 | Lacrimal branch of infraorbital artery (variant)
and tendinous expansion
of levator palpebrae superioris | 36 | Buccal fat pad (temporal process) |
| 17 | Levator palpebrae superioris muscle | 37 | Middle meningeal artery |
| 18 | Ophthalmic artery (nasofrontal artery) | 38 | Periorbita (cut edge) |
| 19 | Fascial sheath of eyeball (TENON's capsule) | 39 | Temporal fascia
(above its division into superficial
and deep layers) |
| 20 | Lacrimal gland (palpebral part)
and posterior border of tendinous expansion
of levator palpebrae superioris muscle | | |

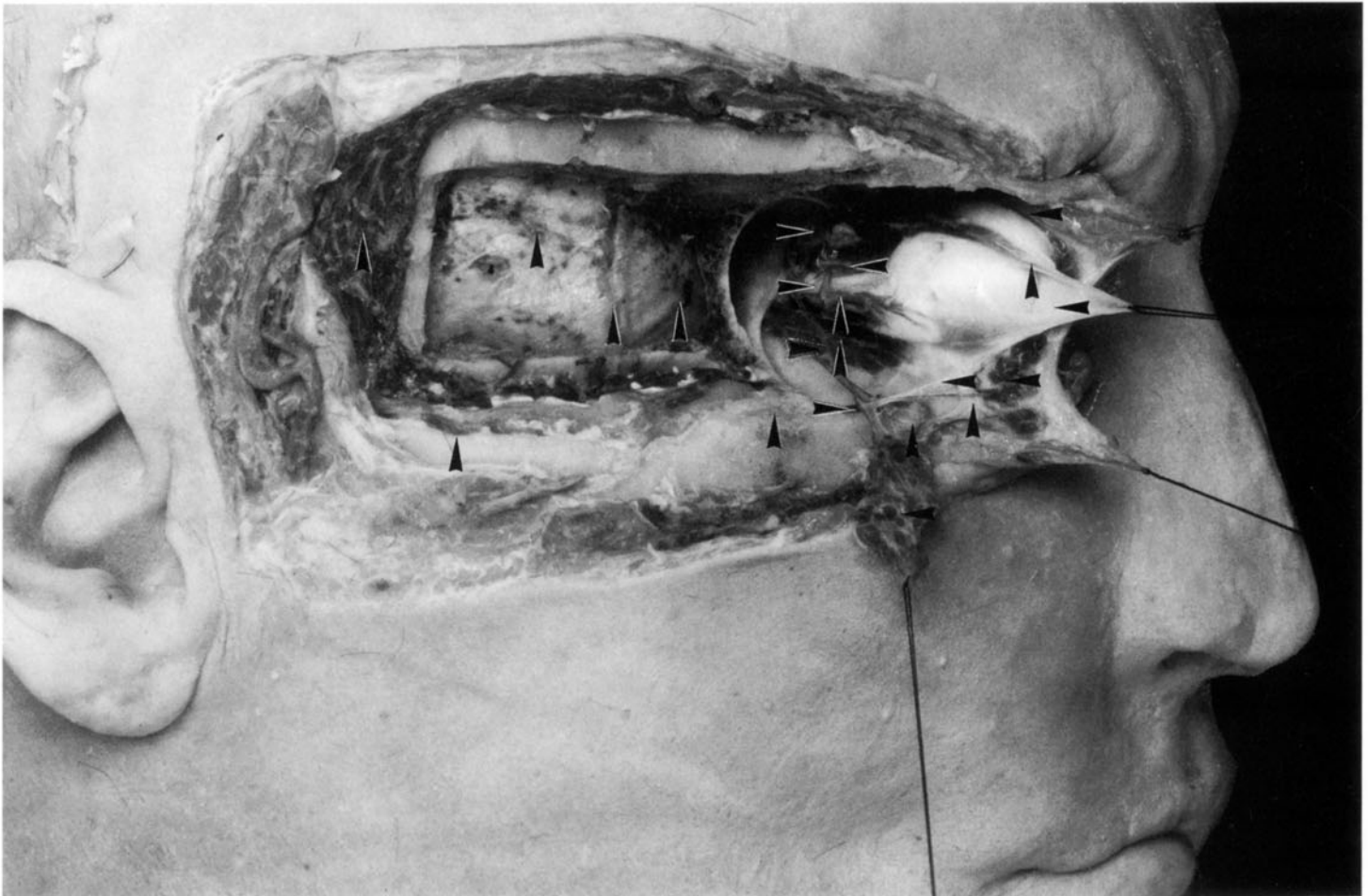
1 2 3 4 5 6 7 8 9 10 11 12

39
38
37
36



13
14
15
16

35
34
33
32



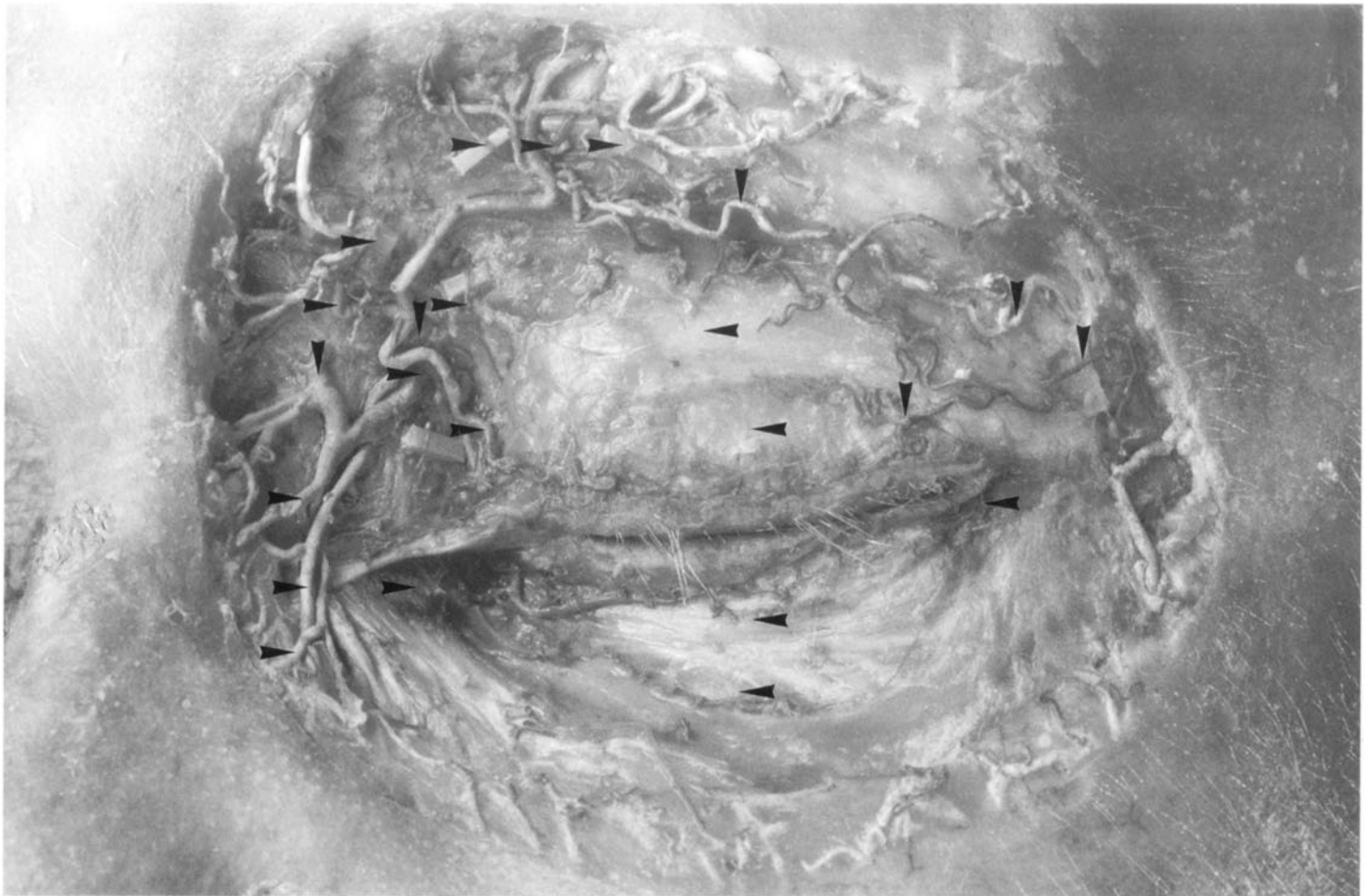
17
18
19
20
21

31 30 29 28 27 26 25 24 23 22

- | | | | |
|----|--|----|---|
| 1 | Supratrochlear vein (frontal vein) | 21 | Infraorbital margin |
| 2 | Superior ophthalmic vein
(upper branch – supratrochlear emergence) | 22 | Inferior palpebral arch |
| 3 | Supraorbital vein | 23 | Superior palpebral arch |
| 4 | Lateral palpebral arteries (superior) | 24 | Medial (inferior) palpebral artery |
| 5 | Middle temporal vein | 25 | Posterior lacrimal crest |
| 6 | Zygomatico-orbital artery | 26 | Anterior lacrimal crest |
| 7 | Orbital septum | 27 | Angular vein |
| 8 | Superior tarsus | 28 | Lacrimal sac |
| 9 | Lateral palpebral artery (inferior) | 29 | Dorsal nasal artery |
| 10 | Inferior tarsus | 30 | Artery and nerve of lacrimal sac |
| 11 | Orbital septum | 31 | Nasofrontal vein and infratrochlear nerve |
| 12 | Supraorbital margin | 32 | Supratrochlear artery and nerve |
| 13 | Extension of orbital fat | 33 | Anastomosis between supratrochlear
and supraorbital arteries |
| 14 | Lacrimal gland (orbital part) | 34 | External nasal vein |
| 15 | Fascial expansion
from levator palpebrae superioris | 35 | Lacrimal fascia |
| 16 | Orbital septum (inner surface) | 36 | External nasal vein |
| 17 | Transverse facial vein | 37 | Palpebral artery (superior) |
| 18 | Zygomatic bone | 38 | Superior ophthalmic vein
(lower branch – infratrochlear emergence) |
| 19 | Connection of fascial expansion
from levator palpebrae superioris muscle
with orbital septum | 39 | Supratrochlear artery and nerve |
| 20 | Posterior conjunctival branch of lacrimal artery | 40 | Supraorbital nerve (medial branch) |
| | | 41 | Supraorbital nerve (lateral branch)
and supraorbital artery |

1 2 3 4 5 6

41
40
39
38
37
36
35
34



7
8
9
10
11

33
32
31
30
29
28
27



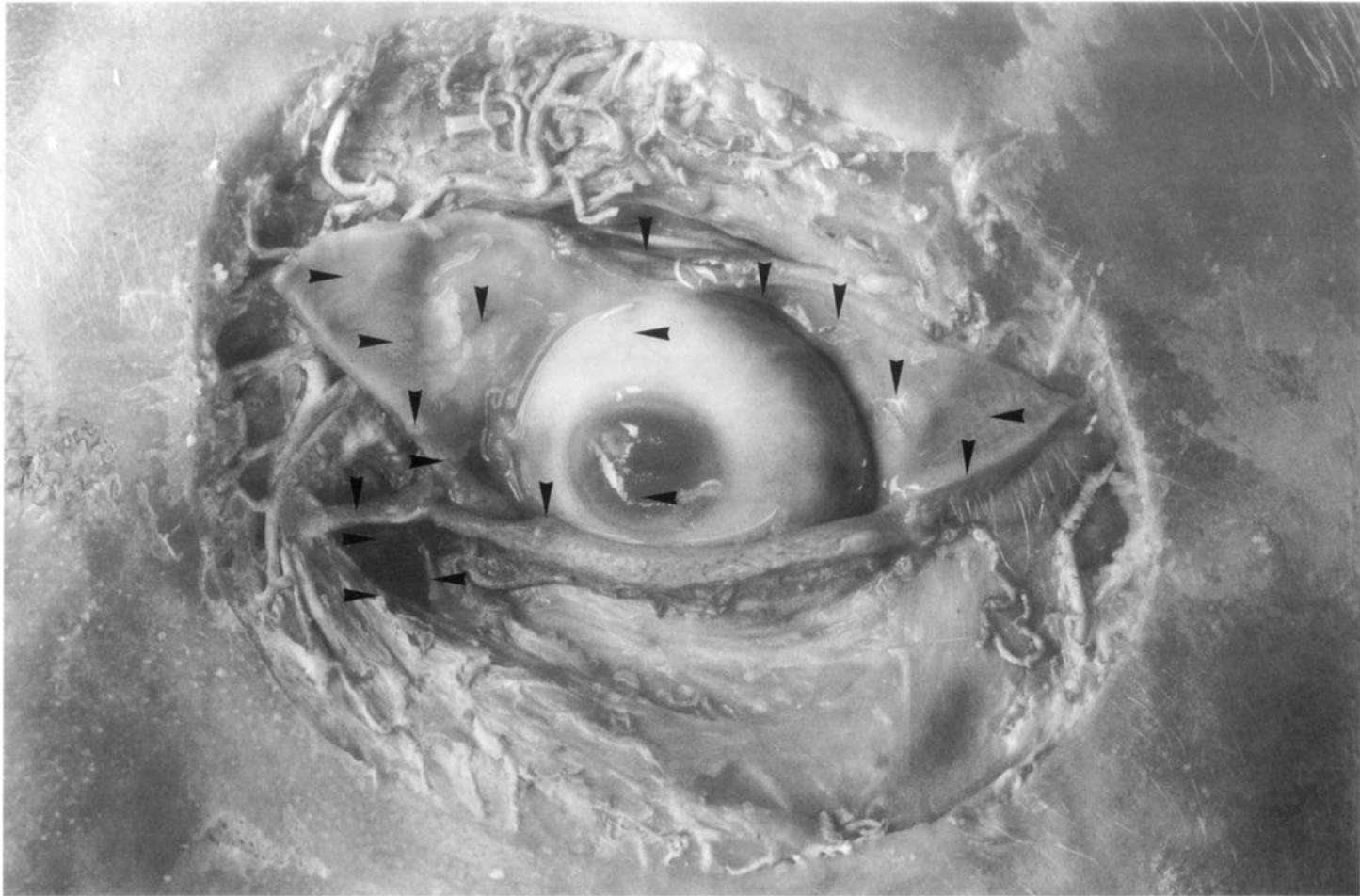
12
13
14
15
16
17
18

26 25 24 23 22 21 20 19

- | | |
|--|--|
| 1 Medial palpebral ligament | 16 Lateral palpebral commissure |
| 2 Lacrimal punctum of upper eyelid | 17 Superior tarsus with tarsal glands (of MEIBOM) |
| 3 Posterior conjunctival artery
(from medial palpebral artery) | 18 Posterior conjunctival artery
(from lacrimal artery) |
| 4 Lacrimal punctum | 19 Limbus of cornea |
| 5 Levator palpebrae superioris muscle
(split by sagittal incision) | 20 Conjunctiva |
| 6 Superficial conjunctival fornix | 21 Lacrimal caruncle |
| 7 Posterior conjunctival artery
(from lacrimal artery) | 22 Medial palpebral ligament |
| 8 Posterior conjunctival artery
(from lacrimal artery) | 23 Lacrimal sac |
| 9 Posterior palpebral limbus | 24 Semilunar fold of conjunctiva |
| 10 Anterior ciliary artery on the eyeball
(covered by ocular conjunctiva) | 25 Muscular fascia of ocular sheath
(superior rectus muscle sheath, cut edges) |
| 11 Superior tarsus with tarsal glands (of MEIBOM) | 26 Superior tarsus with tarsal glands (of MEIBOM) |
| 12 Iris visible through cornea | 27 Medial fascial expansion
from levator palpebrae superioris
and superior rectus to trochlea
of obliquus superior muscle |
| 13 Posterior lacrimal crest (of lacrimal bone) | 28 Anterior lacrimal crest of maxilla |
| 14 Superior rectus muscle
and lateral fascial expansion
from levator palpebrae superioris
and superior rectus muscles | 29 Lacrimal sac |
| 15 Posterior conjunctival artery
(from lacrimal artery) | 30 Accessory lacrimal punctum (variant) |
| | 31 Vascular network
formed by posterior conjunctival arteries |
| | 32 Superior tarsus with tarsal glands (of MEIBOM) |

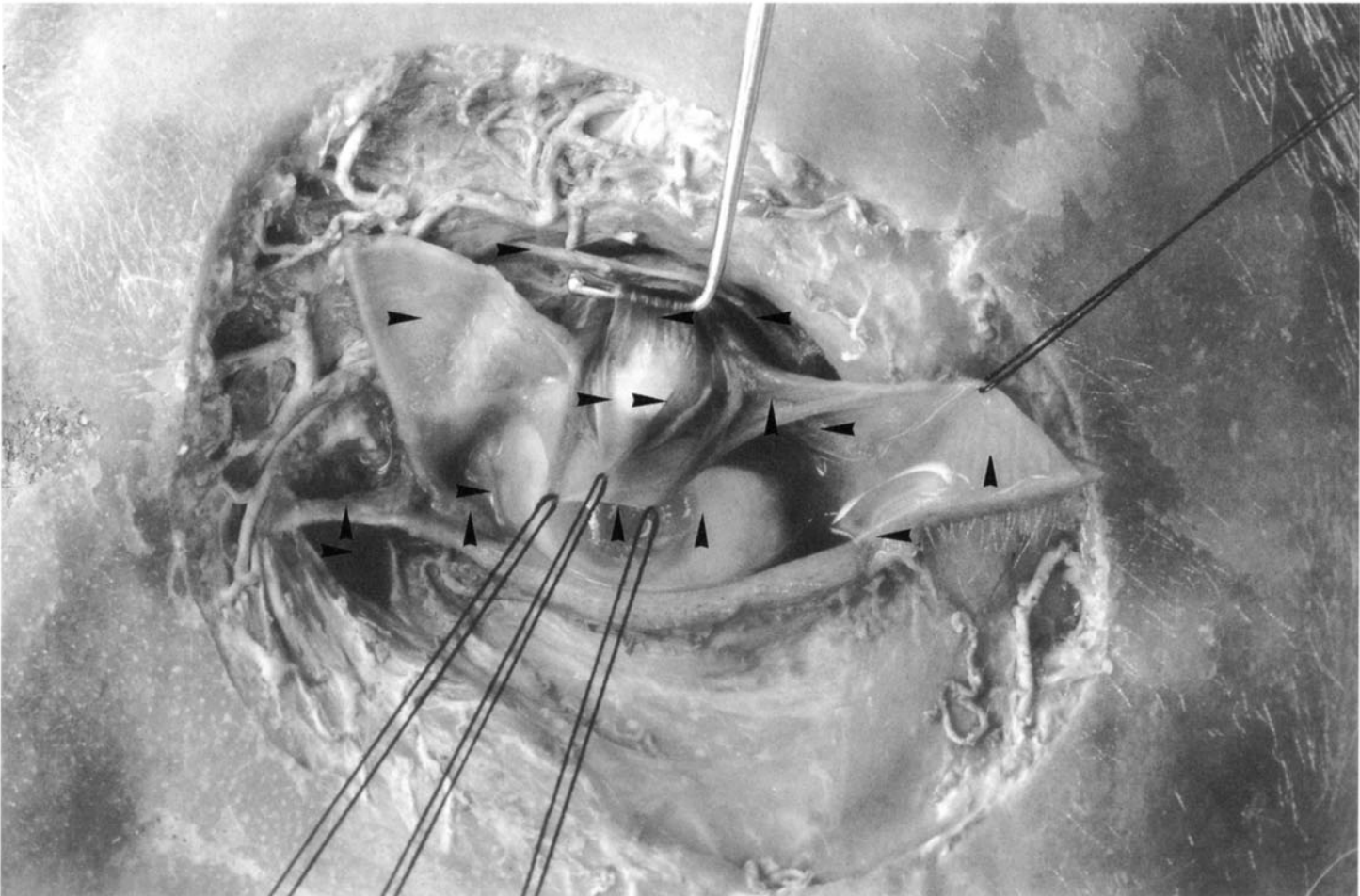
1 2 3 4 5 6 7 8 9

32
31
30
29
28



10
11
12
13

27
26
25
24
23



14
15
16

22 21 20 19 18 17

Figure 52

**Occipital Region
and Posterior Cervical Region 1**

- | | | | |
|----|--|----|---|
| 1 | Auricularis posterior muscle | 16 | Dorsal ramus of C4 |
| 2 | Auricularis superior muscle | 17 | Dorsal ramus of C5 |
| 3 | Lesser occipital nerve
(branch to posterior surface of auricle) | 18 | Dorsal ramus of C6 |
| 4 | Occipital belly of occipitofrontalis muscle | 19 | Dorsal ramus of C7 |
| 5 | Supreme nuchal line (origin of occipital belly) | 20 | Seventh cervical vertebra
(vertebra prominens) |
| 6 | Transversus nuchae muscle | 21 | Ligamentum nuchae |
| 7 | Supreme nuchal line | 22 | Trapezius muscle (aponeurosis) |
| 8 | External occipital protuberance | 23 | Arterial branch of deep cervical artery |
| 9 | Occipital artery | 24 | Trapezius muscle |
| 10 | Occipital belly of occipitofrontalis muscle | 25 | Sternocleidomastoid muscle |
| 11 | Occipital plane | 26 | Second occipitalis minor nerve |
| 12 | Occipital artery | 27 | Great auricular nerve |
| 13 | Superior nuchal line
(attachment of sternocleidomastoid muscle) | 28 | Splenius capitis muscle |
| 14 | Greater occipital nerve | 29 | Lesser occipital nerve |
| 15 | Third occipital nerve | 30 | Posterior auricular artery |
| | | 31 | Posterior auricular branch of facial nerve |

1 2 3 4 5 6 7 8 9 10



Figure 53 **Occipital Region
and Posterior Cervical Region 2**

- | | |
|---|--|
| 1 Occipital lymph node | 10 Posterior auricular branch of facial nerve |
| 2 Connective tissue arch between
sternocleidomastoid and trapezius muscles | 11 Infraauricular lymph nodes |
| 3 Anastomosis between lesser occipital nerve
and greater occipital nerve | 12 Great auricular nerve (posterior branch) |
| 4 Occipital belly of occipitofrontalis muscle | 13 Great auricular nerve (anterior branch) |
| 5 Auricularis posterior muscle | 14 Great auricular nerve |
| 6 Auricularis superior muscle
(posterior part, blends with galea aponeurotica
of occipital belly) | 15 Sternocleidomastoid muscle |
| 7 Lesser occipital nerve
(branch to posterior surface of auricle) | 16 Lesser occipital nerve |
| 8 Auricularis superior muscle (anterior part) | 17 Trapezius muscle |
| 9 Mastoid (retroauricular) lymph nodes | 18 Trapezius muscle (separate bundle) |
| | 19 Splenius capitis muscle |
| | 20 Lesser occipital nerve |
| | 21 Greater occipital nerve
and occipital lymph node |
| | 22 Occipital artery |

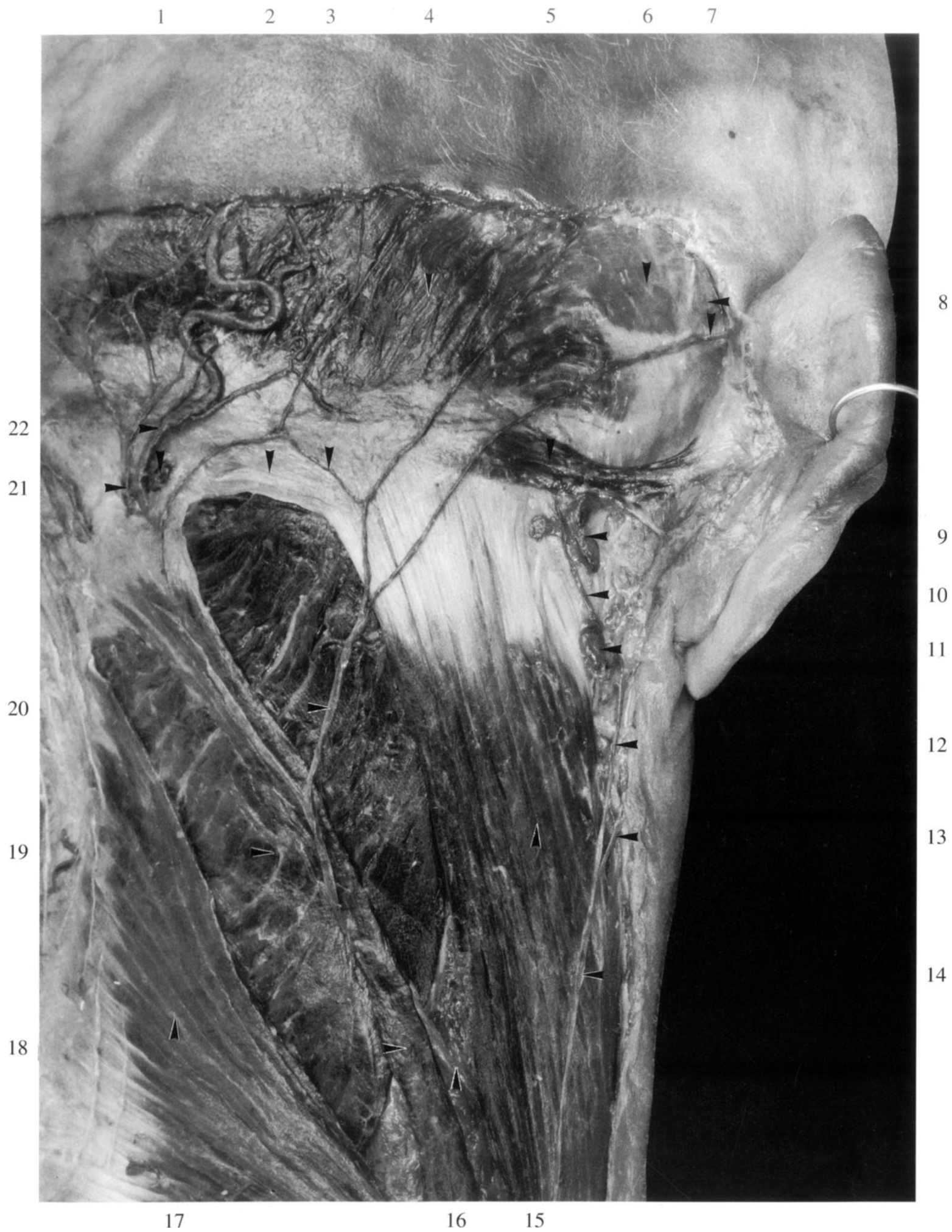


Figure 54 **Occipital Region
and Posterior Cervical Region 3**

- | | | | |
|----|---|----|--|
| 1 | Trapezius muscle (cut surface) | 23 | Iliocostalis thoracis muscle |
| 2 | Sternocleidomastoid muscle | 24 | Scapula (medial border)
and dorsal scapular artery |
| 3 | Occipital belly of occipitofrontalis muscle | 25 | Scapular spine |
| 4 | Semispinalis capitis muscle | 26 | Transverse cervical artery |
| 5 | External occipital protuberance | 27 | Levator scapulae muscle |
| 6 | Semispinalis capitis muscle | 28 | Longissimus thoracis muscle |
| 7 | Occipital artery | 29 | Splenius cervicis muscle |
| 8 | Sternocleidomastoid muscle | 30 | Second thoracic nerve (dorsal ramus)
and posterior branch
of second posterior intercostal artery |
| 9 | Trapezius muscle (cut surface) | 31 | Levator scapulae muscle |
| 10 | Scalp (cut surface) | 32 | Supraspinatus muscle |
| 11 | Occipital artery (occipital branch) | 33 | Superior angle of scapula |
| 12 | Occipital plane | 34 | Dorsal scapular nerve |
| 13 | Greater occipital nerve | 35 | Accessory nerve |
| 14 | Lesser occipital nerve | 36 | Splenius cervicis muscle |
| 15 | Third occipital nerve | 37 | Splenius capitis muscle |
| 16 | Third cervical nerve (dorsal ramus) | 38 | Lesser occipital nerve |
| 17 | Seventh cervical vertebra | 39 | Ligamentum nuchae |
| 18 | Splenius cervicis muscle | 40 | Greater occipital nerve |
| 19 | Serratus posterior superior muscle | 41 | Occipital artery |
| 20 | Dorsal scapular nerve | | |
| 21 | Accessory nerve | | |
| 22 | Supraspinatus muscle | | |

1 2 3 4 5 6 7 8 9

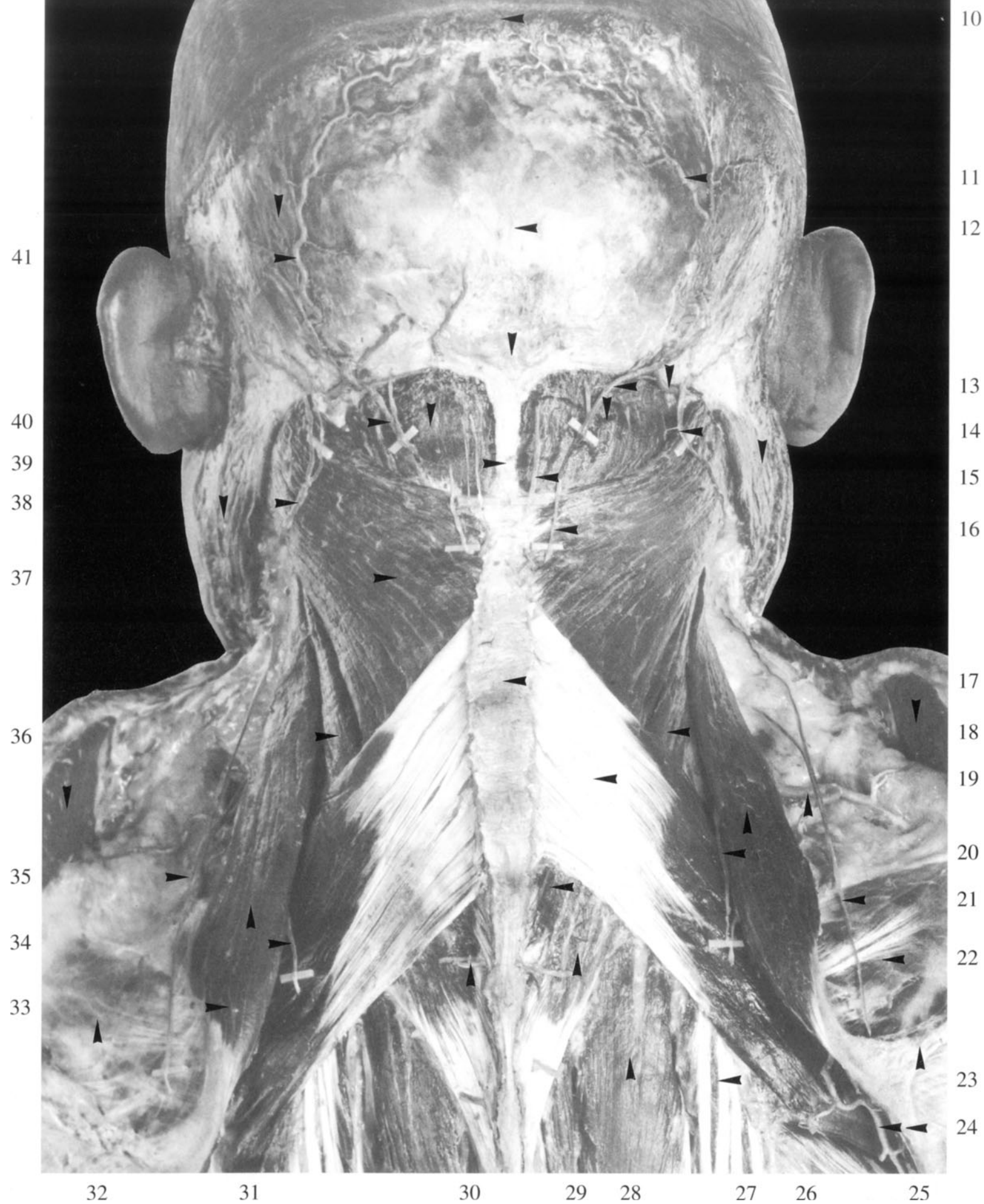


Figure 55 **Occipital Region
and Posterior Cervical Region 4**

- | | |
|---|---|
| 1 Sternocleidomastoid muscle | 21 Seventh cervical nerve (dorsal ramus) |
| 2 Splenius capitis muscle (cut surface) | 22 Scapula (medial border) |
| 3 External occipital protuberance | 23 Longissimus thoracis muscle |
| 4 Greater occipital nerve | 24 Supraspinatus muscle |
| 5 Splenius cervicis muscle (resected) | 25 Suprascapular nerve and artery |
| 6 Splenius capitis muscle
and lesser occipital nerve | 26 Dorsal scapular nerve |
| 7 Sternocleidomastoid muscle | 27 Iliocostalis cervicis muscle |
| 8 Scalp | 28 Longissimus cervicis muscle |
| (cut surface with branches of occipital artery) | 29 Levator scapulae muscle |
| 9 Occipital artery (occipital branch) | 30 Scapular spine |
| 10 Occipital plane of occipital squama | 31 Trapezius muscle (cut surface) |
| 11 Semispinalis capitis muscle | 32 Rhomboideus major muscle (cut surface) |
| 12 Third occipital nerve | 33 Iliocostalis thoracis muscle |
| 13 Longissimus capitis muscle | 34 Scapula (superior angle) |
| 14 Fourth cervical nerve (dorsal ramus) | 35 Dorsal scapular nerve |
| 15 Accessory nerve | 36 Accessory nerve |
| 16 Levator scapulae muscle | 37 Longissimus capitis muscle
(tendinous intersection) |
| 17 Longissimus capitis muscle | 38 Transverse cervical artery |
| 18 Fifth cervical nerve (dorsal ramus) | 39 Longissimus capitis muscle |
| 19 Seventh cervical vertebra | 40 Splenius cervicis muscle (resected) |
| 20 Sixth cervical nerve (dorsal ramus) | 41 Lesser occipital nerve |

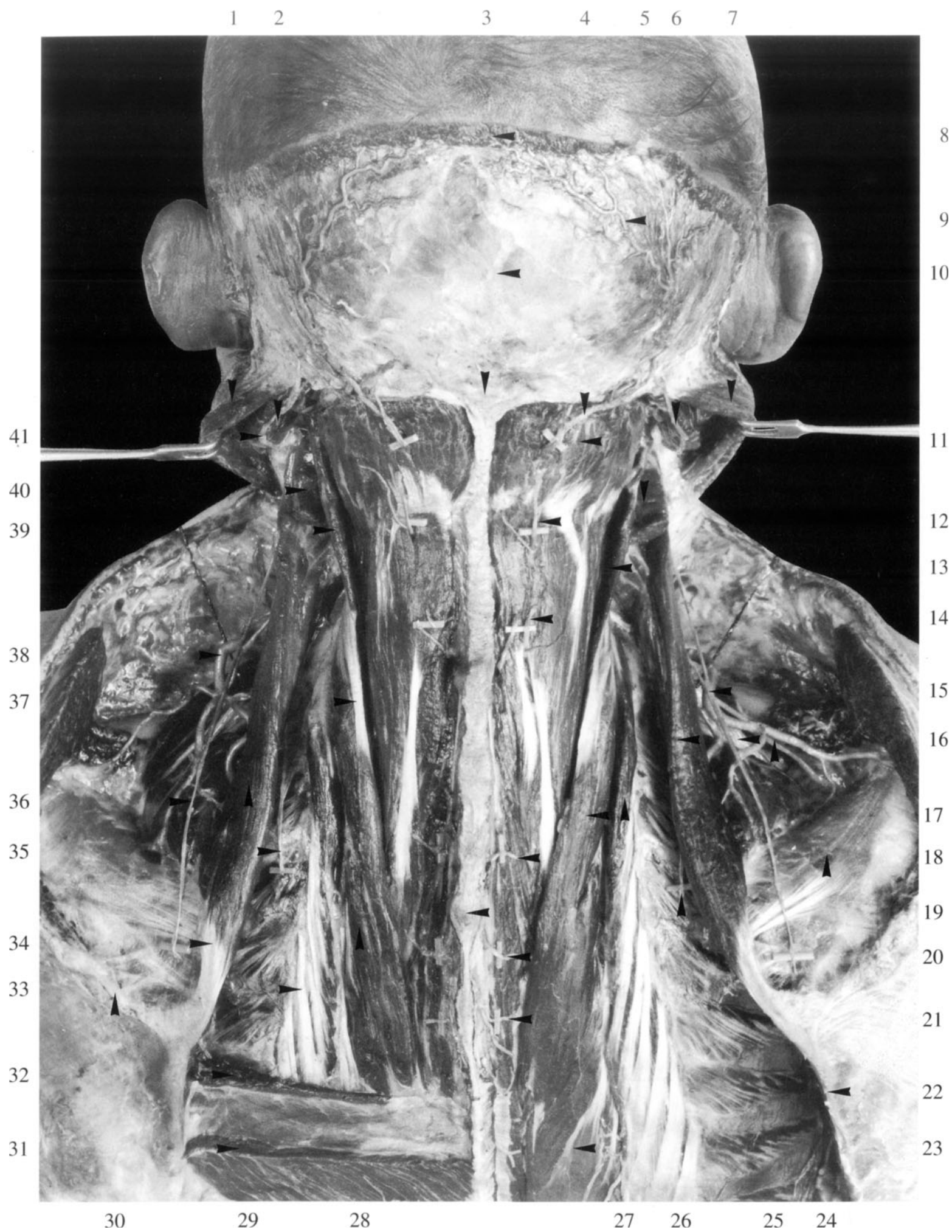


Figure 56 **Occipital Region
and Posterior Cervical Region 5**

- | | |
|---|--|
| 1 Sternocleidomastoid muscle
(tendon of insertion) | 17 Longissimus capitis muscle
with tendinous intersection |
| 2 Occipitofrontalis muscle (occipital belly) | 18 Lesser occipital nerve |
| 3 Supreme nuchal line (origin of occipital belly) | 19 Splenius capitis muscle |
| 4 Superior nuchal line
(insertion of semispinalis capitis) | 20 Seventh cervical vertebra |
| 5 External occipital protuberance | 21 Third thoracic vertebra (spinous process) |
| 6 Third occipital nerve | 22 Levator scapulae muscle |
| 7 Semispinalis capitis muscle (medial part) | 23 Iliocostalis thoracis muscle |
| 8 Semispinalis capitis muscle (lateral part) | 24 Splenius cervicis muscle |
| 9 Occipitofrontalis muscle (occipital belly) | 25 Splenius cervicis muscle |
| 10 Sternocleidomastoid muscle
(tendon of insertion) | 26 Iliocostalis thoracis muscle |
| 11 Occipital plane of occipital squama | 27 Longissimus thoracis muscle |
| 12 Occipital artery | 28 Levator scapulae muscle |
| 13 Greater occipital nerve | 29 Lesser occipital nerve |
| 14 Ligamentum nuchae | 30 Longissimus capitis muscle |
| 15 Splenius capitis muscle (cut surface) | 31 Semispinalis capitis muscle
(lateral and medial parts) |
| 16 Longissimus capitis muscle | 32 Occipital artery |
| | 33 Splenius capitis muscle (cut surface) |
| | 34 Lesser occipital nerve |

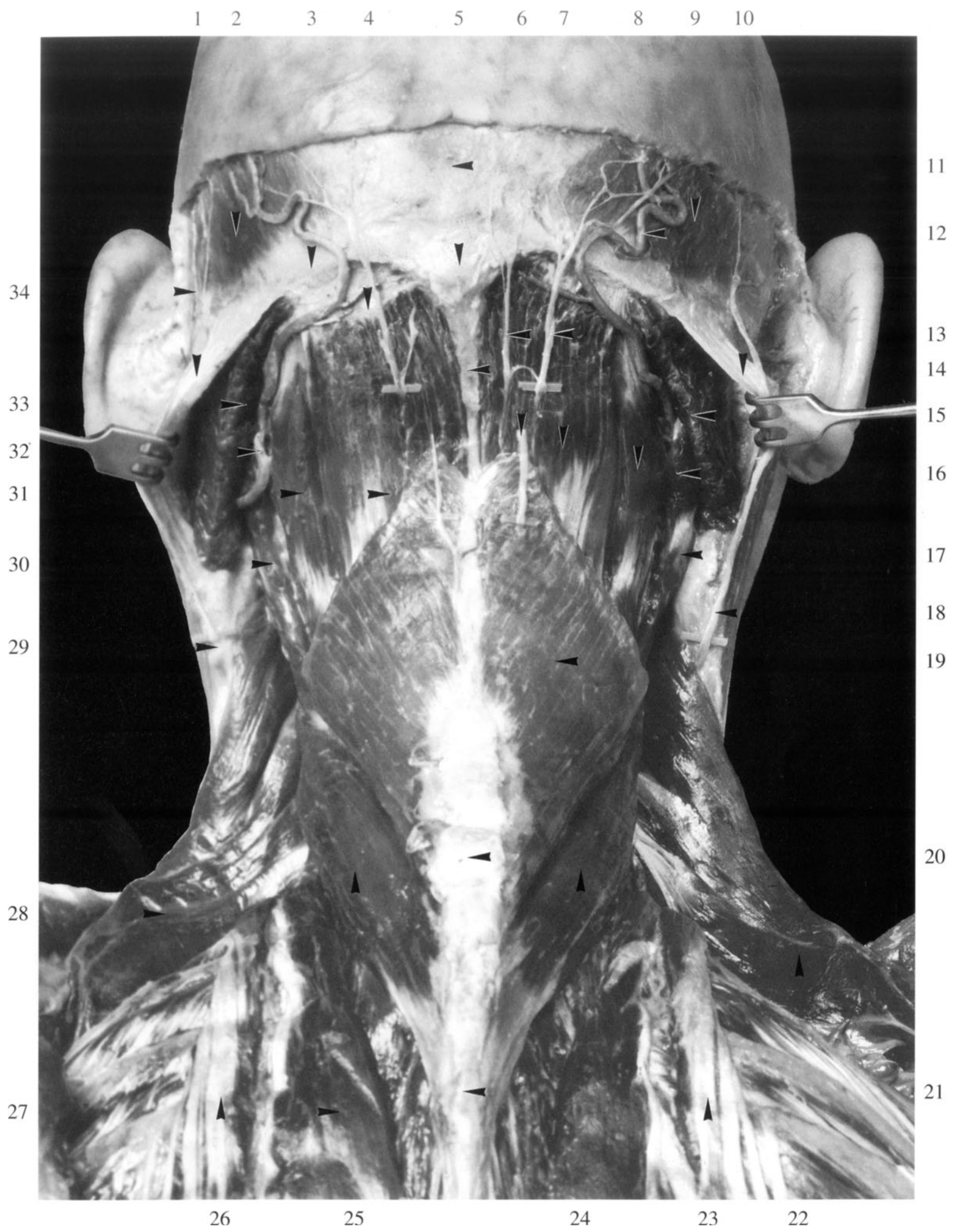


Figure 57**Occipital Region
and Posterior Cervical Region 6**

- | | | | |
|----|---|----|--|
| 1 | Splenius capitis muscle (cut surface) | 21 | Iliocostalis cervicis muscle |
| 2 | Upper tendinous intersection
of semispinalis capitis muscle
(with downward extension in lateral part) | 22 | Levator scapulae muscle |
| 3 | Upper tendinous intersection
of semispinalis capitis muscle
(with upward extension in medial part) | 23 | Splenius cervicis muscle |
| 4 | Upper tendinous intersection
of semispinalis capitis muscle | 24 | Longissimus cervicis muscle |
| 5 | External occipital protuberance | 25 | Semispinalis cervicis muscle |
| 6 | Semispinalis capitis muscle (medial part) | 26 | Longissimus cervicis muscle |
| 7 | Semispinalis capitis muscle (lateral part) | 27 | Splenius cervicis muscle
(inconstant tendon to third thoracic vertebra) |
| 8 | Longissimus capitis muscle | 28 | Levator scapulae muscle |
| 9 | Sternocleidomastoid muscle
(tendon of insertion) | 29 | Semispinalis thoracis muscle |
| 10 | Occipitofrontalis muscle (occipital belly) | 30 | Lower tendinous intersection
of semispinalis capitis muscle |
| 11 | Occipital artery | 31 | Tendinous intersection
of longissimus capitis muscle |
| 12 | Greater occipital nerve | 32 | Upper tendinous intersection
of semispinalis capitis muscle
(downward extension in lateral part) |
| 13 | Splenius capitis muscle (cut surface) | 33 | Fourth cervical nerve (dorsal ramus) |
| 14 | Third occipital nerve | 34 | Longissimus capitis muscle |
| 15 | Longissimus capitis muscle
(inconstant tendinous intersection) | 35 | Third occipital nerve |
| 16 | Axis (epistropheus) (spinous process) | 36 | Semispinalis capitis muscle
(consistent muscle bundle
between middle and upper bellies) |
| 17 | Lesser occipital nerve | 37 | Occipital artery |
| 18 | Interspinales muscles | 38 | Greater occipital nerve |
| 19 | Tendinous intersection
of longissimus capitis muscle | 39 | Sternocleidomastoid muscle
(tendon of insertion) |
| 20 | Seventh cervical vertebra (spinous process) | 40 | Lesser occipital nerve |

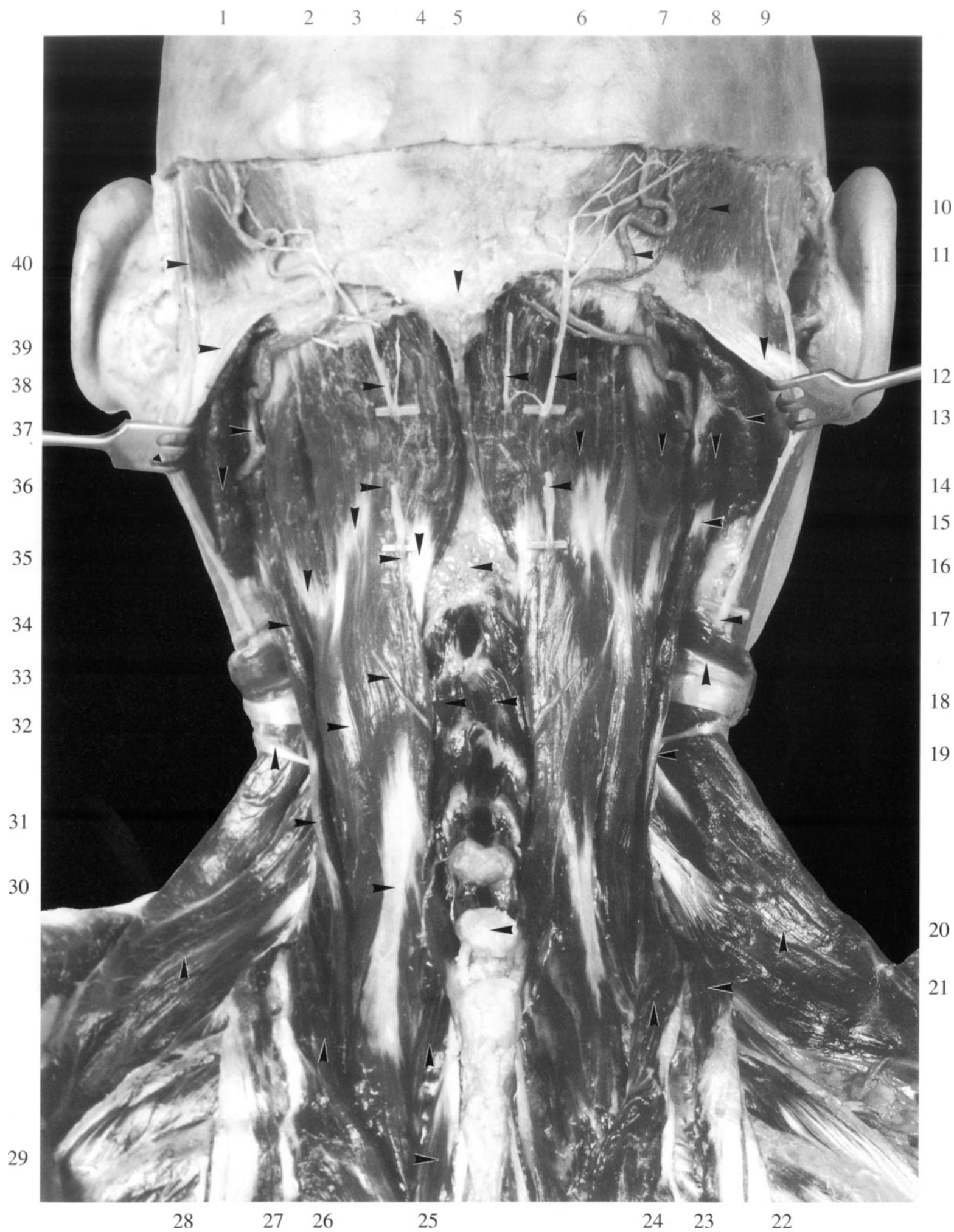


Figure 58 **Occipital Region
and Posterior Cervical Region 7**

- | | |
|--|---|
| 1 Sternocleidomastoid muscle | 21 Accessory nerve |
| 2 Splenius capitis muscle (cut surface) | 22 Dorsal scapular nerve |
| 3 Greater occipital nerve | 23 Medial posterior cutaneous branch
of first thoracic nerve |
| 4 Semispinalis capitis muscle | 24 Suprascapular artery |
| 5 External occipital protuberance | 25 Great auricular nerve |
| 6 Rectus capitis posterior minor muscle | 26 Levator scapulae muscle |
| 7 Rectus capitis posterior major muscle | 27 First thoracic vertebra (transverse process) |
| 8 Occipital anastomosis | 28 Longissimus capitis muscle |
| 9 Occipital artery | 29 Trapezius muscle |
| 10 Splenius capitis muscle (cut surface) | 30 Rhomboideus major muscle |
| 11 Sternocleidomastoid muscle | 31 Longissimus thoracis muscle |
| 12 Lesser occipital nerve | 32 Longissimus cervicis muscle |
| 13 Obliquus capitis superior muscle | 33 Iliocostalis cervicis muscle |
| 14 Greater occipital nerve | 34 Seventh cervical vertebra (spinous process) |
| 15 Longissimus capitis muscle
with tendinous intersection | 35 Fifth cervical nerve (dorsal ramus) |
| 16 Splenius cervicis muscle (cut surface) | 36 Longissimus capitis muscle |
| 17 Fourth cervical nerve (dorsal ramus) | 37 Splenius cervicis muscle (resected) |
| 18 Cervicalis profunda artery | 38 Axis (spinous process) |
| 19 Semispinalis cervicis muscle | 39 Occipital artery |
| 20 Eighth cervical nerve (dorsal ramus) | 40 Lesser occipital nerve |

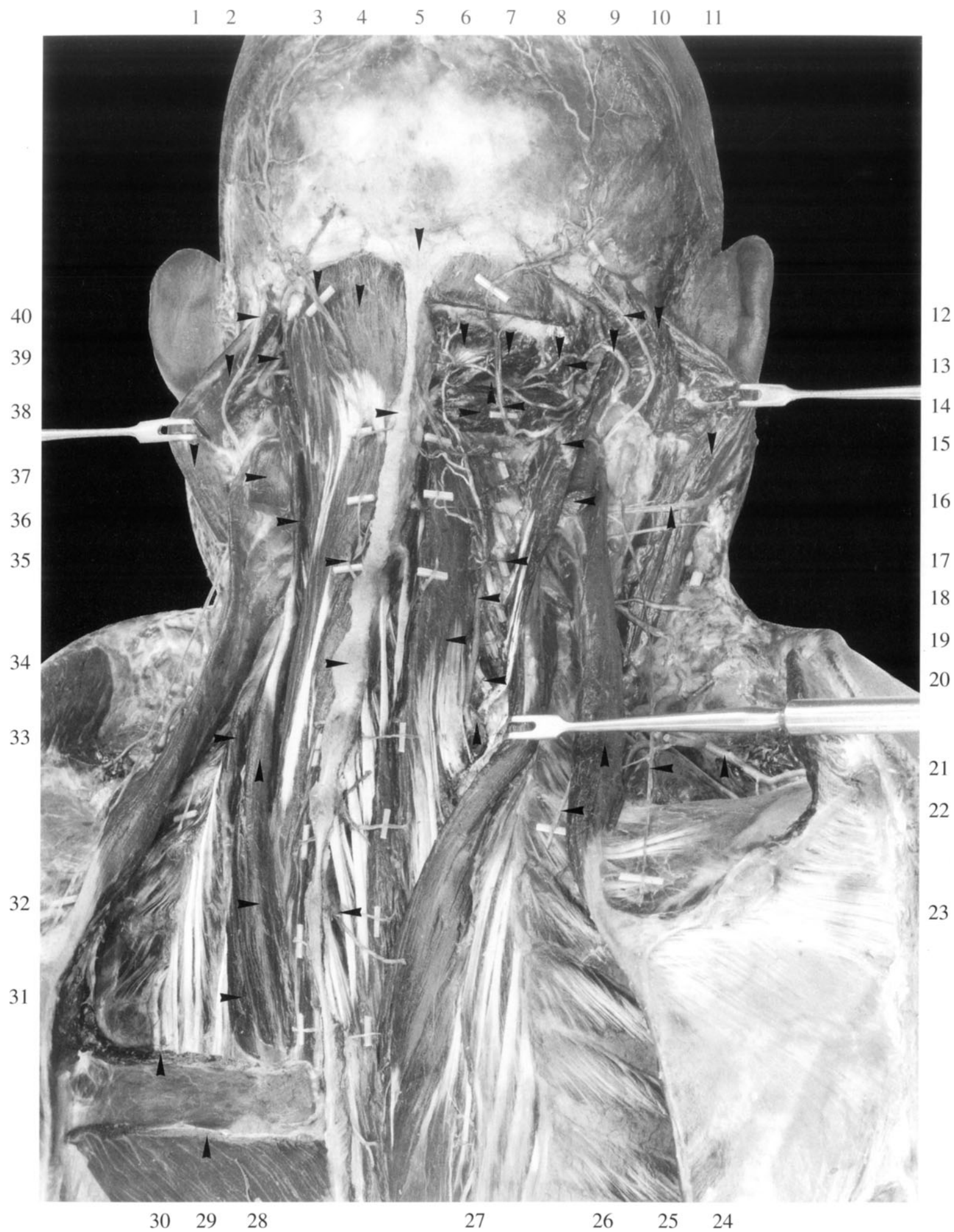


Figure 59 **Suboccipital Puncture 1**
Occipital Region
and Posterior Cervical Region

- | | |
|--|--|
| 1 External occipital protuberance | 19 Levator scapulae muscle |
| 2 Greater occipital nerve
and rectus capitis posterior minor muscle
(cut edge) | 20 Great auricular nerve (posterior branch) |
| 3 Superior nuchal line
(attachment of semispinalis capitis muscle) | 21 Lesser occipital nerve |
| 4 Supreme nuchal line (origin of occipital belly) | 22 Longissimus capitis muscle |
| 5 Occipital artery (descending branch) | 23 Vertebral artery |
| 6 Splenius capitis muscle (cut edge) | 24 Suboccipital nerve and vertebral artery |
| 7 Posterior auricular nerve
and sternocleidomastoid muscle | 25 Foramen magnum (posterior margin) |
| 8 Auricularis superior muscle | 26 Ligamentum nuchae |
| 9 Occipitofrontalis muscle (occipital belly) | 27 Semispinalis cervicis muscle |
| 10 Occipital artery | 28 Subcutaneous tissue (paramedian cut edge) |
| 11 Posterior auricular artery | 29 Skin (paramedian cut edge) |
| 12 Rectus capitis posterior major muscle | 30 Posterior arch of atlas |
| 13 Obliquus capitis superior muscle | 31 Posterior atlanto-occipital membrane |
| 14 Obliquus capitis inferior muscle | 32 Occipital bone (occipital squama) |
| 15 Rectus capitis posterior major muscle (cut edge) | 33 Inferior nuchal line
(divides nuchal plane of occipital bone
into two halves) |
| 16 Vertebral artery (muscular branch) | 34 Semispinalis capitis muscle (resected) |
| 17 Semispinalis capitis muscle (cut edge) | 35 Subgaleal space
(connective tissue space
between pericranium and scalp) |
| 18 Cervicalis profunda artery | |

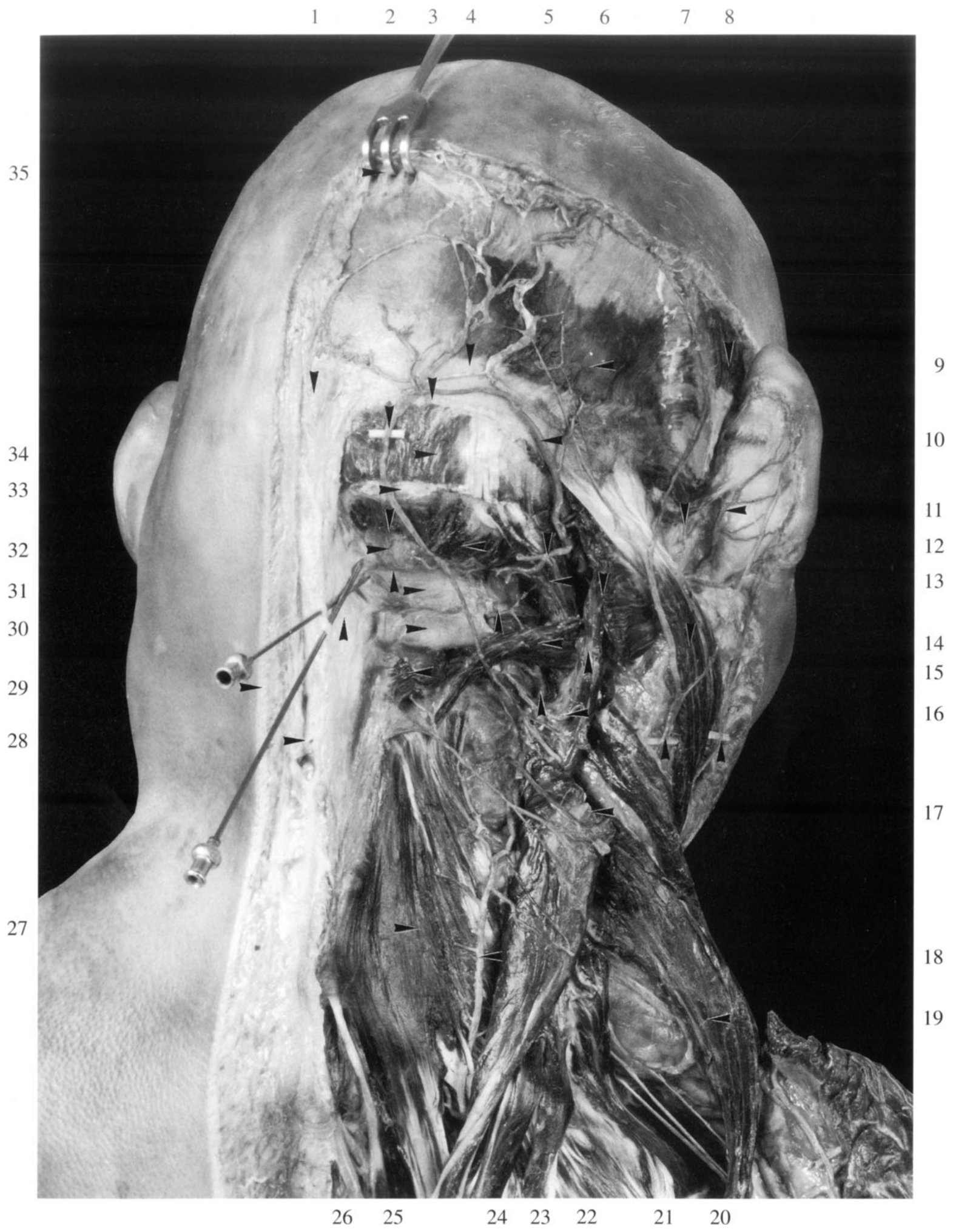


Figure 60 **Suboccipital Puncture 2**
Occipital Region
and Posterior Cervical Region

- | | |
|---|--|
| 1 External occipital protuberance | 23 Vertebral artery and suboccipital nerve |
| 2 Pyramid of vermis | 24 Spinal dura mater (cut edge) |
| 3 Falx cerebri | 25 Obliquus capitis inferior muscle |
| 4 Fourth ventricle with rhomboid fossa | 26 Ligamentum nuchae |
| 5 Superior cerebellar peduncle (cut surface) | 27 First thoracic vertebra |
| 6 Occipital bone (outer surface) | (transverse process, free end) |
| 7 Pericranium | 28 Semispinalis cervicis muscle |
| 8 Pericranium (cut edge) | 29 Cervicalis profunda artery |
| 9 Lambdoid suture | and multifidus muscle |
| 10 Occipitofrontalis muscle | 30 Third cervical vertebra (posterior tubercle) |
| (occipital belly, cut edge) | 31 Third cervical vertebra (anterior tubercle) |
| 11 Lambdoid suture and transverse sinus | 32 Third occipital nerve |
| (opened at junction with sigmoid sinus) | 33 Rectus capitis posterior major muscle |
| 12 Middle cerebellar peduncle (cut surface) | 34 Spinal dura mater |
| 13 Inferior cerebellar peduncle (cut surface) | with dorsal attachment to posterior arch of atlas |
| 14 Occipital bone | 35 Posterior tubercle on posterior arch of atlas |
| (margin of foramen magnum, cut surface) | with origin of rectus capitis |
| 15 Posterior atlanto-occipital membrane | posterior minor muscle |
| (cut surface) | 36 Posterior atlanto-occipital membrane (cut edge) |
| 16 Splenius capitis muscle (cut surface) | 37 Occipital bone |
| 17 Second cervical nerve | (margin of foramen magnum, cut surface) |
| (spinal ganglion and greater occipital nerve) | 38 Tela choroidea of fourth ventricle |
| 18 Vertebral artery | with choroid plexus |
| 19 Ansa cervicalis (posterior root) | 39 Falx cerebelli |
| 20 Third cervical nerve | 40 Transverse sinus |
| (ventral ramus in sulcus of spinal nerve) | (opened before its termination |
| 21 Levator scapulae muscle | at confluent sinus) |
| 22 Sternocleidomastoid muscle | 41 Superior sagittal sinus (opened) |
| and lesser occipital nerve | |

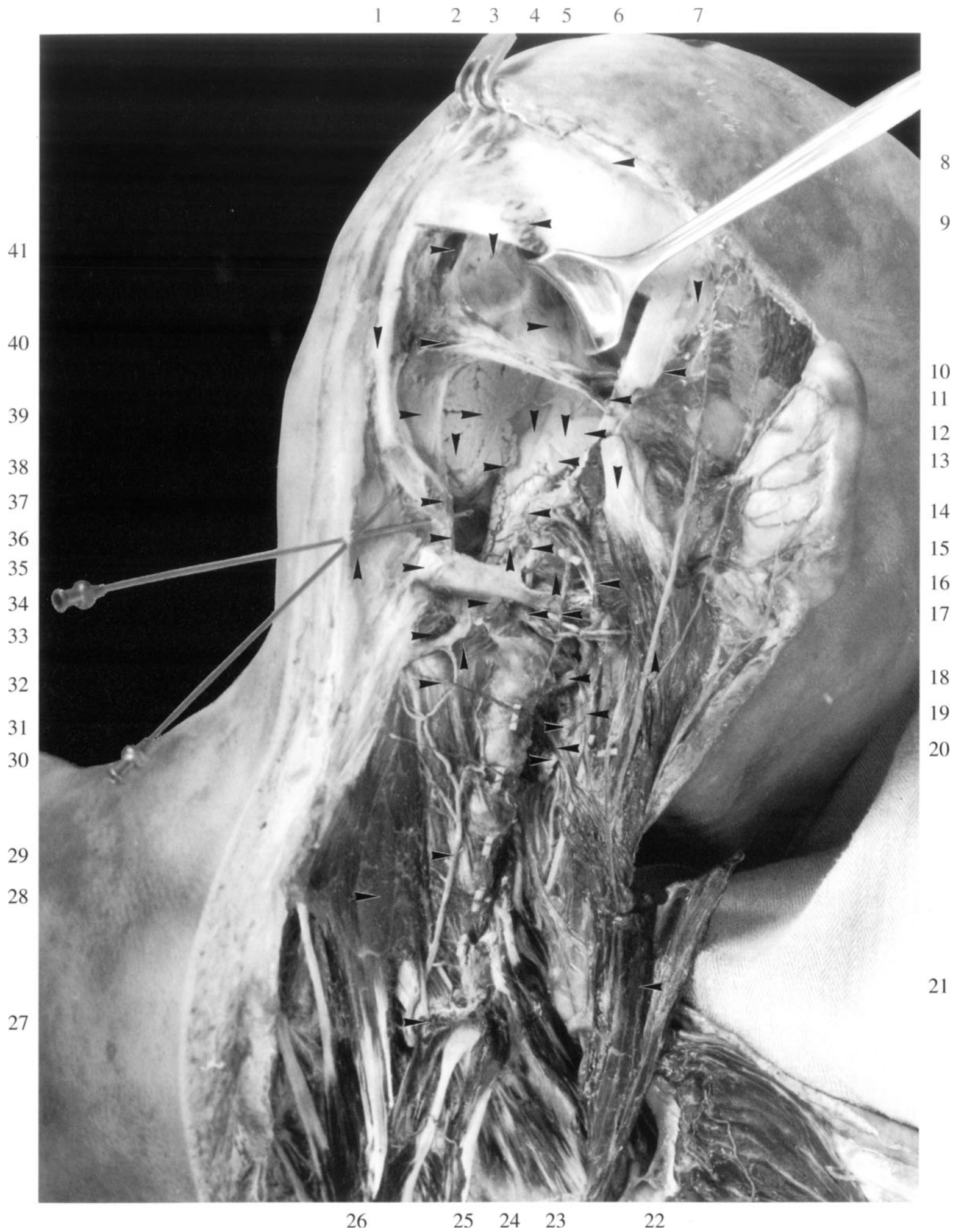


Figure 61

**Suprascapular Region 1
Posterior Cervical Region**

- | | | | |
|----|---|----|--|
| 1 | External occipital protuberance | 16 | Supraspinous fascia with tendinous expansions of trapezius muscle |
| 2 | Greater occipital nerve | 17 | [Spinous tubercle] |
| 3 | Occipital artery | 18 | Transverse cervical artery (descending cutaneous branch of superficial branch) |
| 4 | Anastomosis between greater and lesser occipital nerves | 19 | Transverse cervical artery (supraspinous branch of deep branch) |
| 5 | Occipitofrontalis muscle (occipital belly) | 20 | Trapezius muscle (ascending part) |
| 6 | Auricularis posterior muscle | 21 | Second thoracic nerve (dorsal ramus) |
| 7 | Auricularis superior muscle | 22 | Transverse cervical artery (descending cutaneous branch of superficial branch) |
| 8 | Posterior auricular nerve and artery | 23 | Third thoracic vertebra (spinous process) |
| 9 | Sternocleidomastoid muscle | 24 | Second thoracic vertebra (spinous process) |
| 10 | Great auricular nerve (posterior branch) | 25 | First thoracic vertebra (spinous process) |
| 11 | Lesser occipital nerve | 26 | Seventh cervical vertebra (spinous process) |
| 12 | Trapezius muscle (descending part) | 27 | Skin (cut edge) |
| 13 | Transverse cervical artery (ascending cutaneous branch of superficial branch) | 28 | Third occipital nerve |
| 14 | Transverse cervical artery (ascending cutaneous branch of superficial branch) | 29 | Splenius capitis muscle |
| 15 | Trapezius muscle (transverse part) | 30 | Subcutaneous tissue (cut surface) |

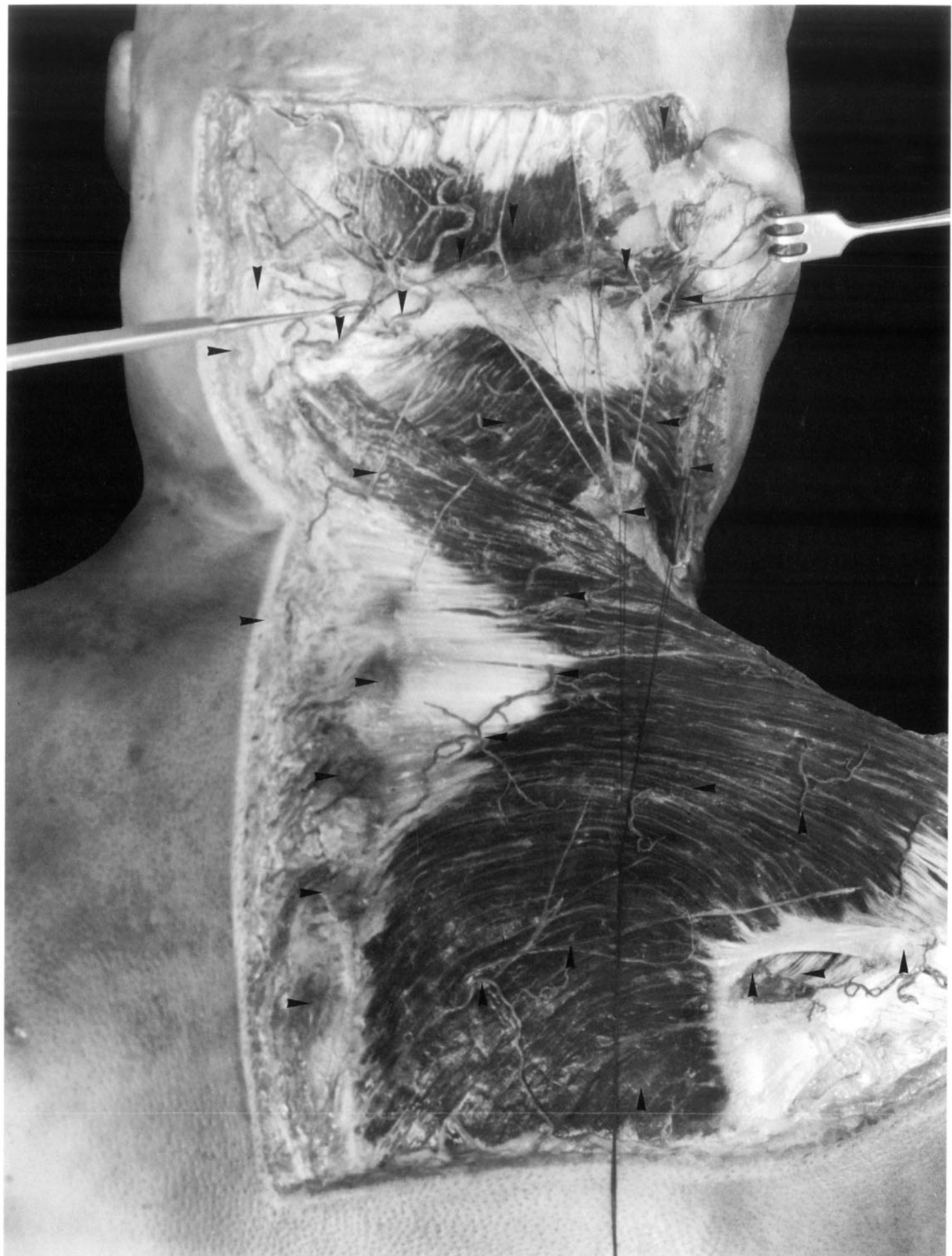


Figure 62**Suprascapular Region 2
Posterior Cervical Region**

- | | | | |
|----|--|----|--|
| 1 | External occipital protuberance | 21 | Acromion with acromial rete |
| 2 | Semispinalis capitis muscle | 22 | Acromioclavicular joint |
| 3 | Supreme nuchal line with origin of occipital belly | 23 | Scapular spine |
| 4 | Occipitofrontalis muscle (occipital belly) | 24 | Trapezius muscle (cut surface) |
| 5 | Sternocleidomastoid muscle (tendon) | 25 | Transverse cervical artery (descending branch) |
| 6 | Auricularis posterior muscle | 26 | Transverse cervical artery (ascending branch) |
| 7 | Auricularis superior muscle | 27 | Rhomboideus minor muscle |
| 8 | Posterior auricular branch of facial nerve | 28 | Rhomboideus major muscle |
| 9 | Posterior auricular artery | 29 | Trapezius muscle (ascending part) |
| 10 | Lesser occipital nerve | 30 | Third thoracic vertebra (spinous process) |
| 11 | Splenius cervicis muscle (stump) | 31 | Trapezius muscle (transverse part) |
| 12 | Longissimus capitis muscle | 32 | First thoracic vertebra (spinous process) |
| 13 | Levator scapulae muscle | 33 | Serratus posterior superior muscle (tendon) |
| 14 | Trapezian branch of cervical plexus | 34 | Seventh cervical vertebra (spinous process) |
| 15 | Transverse cervical artery | 35 | Third occipital nerve |
| 16 | Accessory nerve | 36 | Ligamentum nuchae |
| 17 | Dorsal scapular nerve | 37 | Splenius capitis muscle |
| 18 | Transverse cervical artery (deep branch)
[dorsal scapular artery] | 38 | Greater occipital nerve |
| 19 | Deltoid muscle (origin on scapular spine) | 39 | Occipital artery |
| 20 | Supraspinous fascia with expansions
from ascending part of trapezius muscle | 40 | Galea aponeurotica |

1 2 3 4 5 6

40

39

38

37

36

35

34

33

32

31

30

29

7

8

9

10

11

12

13

14

15

16

17

18

19

20

28

27

26

25

24

23

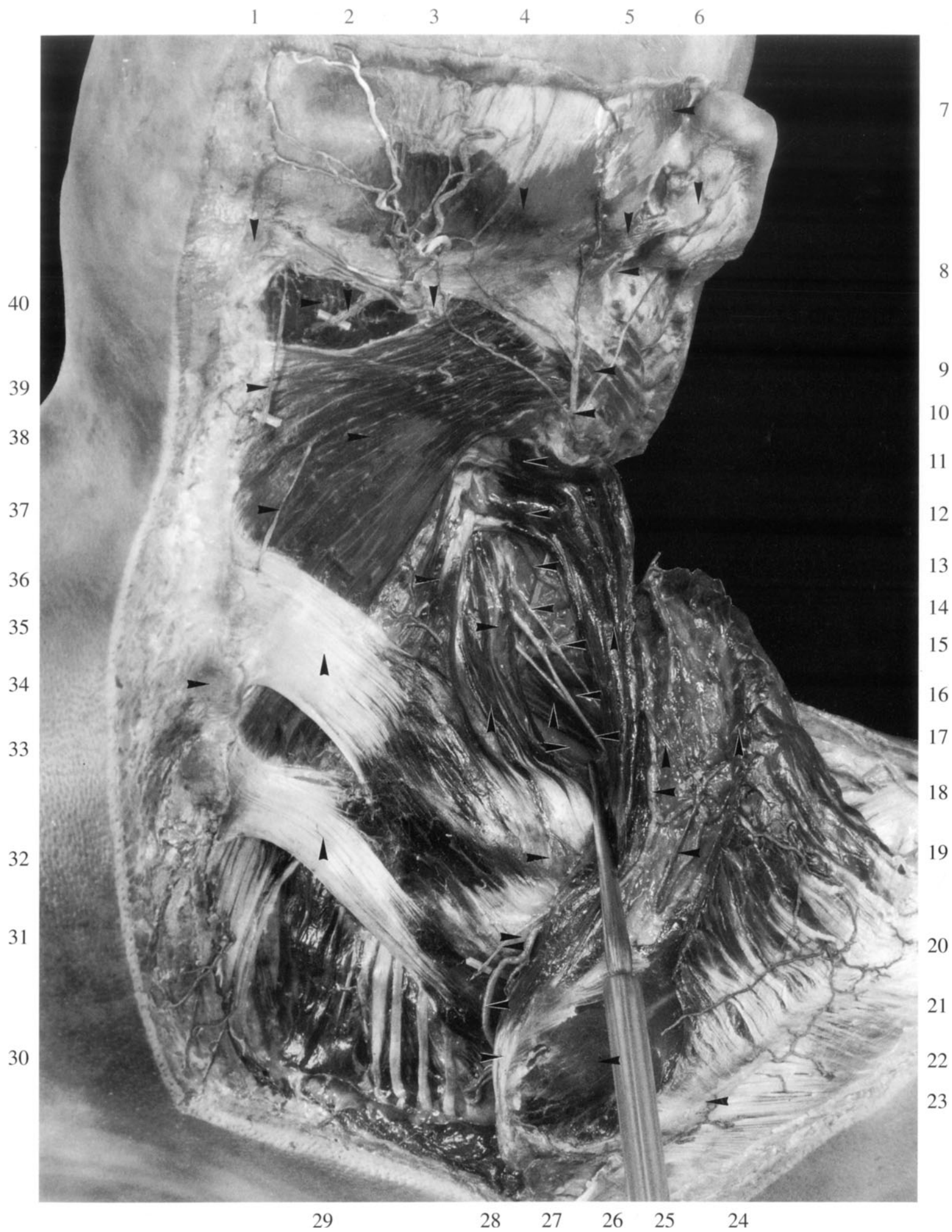
22

21

Figure 63

**Suprascapular Region 3
Posterior Cervical Region**

- | | | | |
|----|--|----|---|
| 1 | External occipital protuberance | 22 | Supraspinatus muscle |
| 2 | Greater occipital nerve | 23 | Scapular spine |
| 3 | Occipital artery | 24 | Trapezius muscle (cut surface) |
| 4 | Occipitofrontalis muscle (occipital belly) | 25 | Trapezian branch of cervical plexus |
| 5 | Auricularis posterior muscle | 26 | Levator scapulae muscle |
| 6 | Eminence of concha | 27 | Scalenus medius muscle |
| 7 | Auricularis superior muscle | 28 | Scalenus posterior muscle |
| 8 | Posterior auricular branch of facial nerve | 29 | Serratus posterior superior muscle
(aponeurotic origins) |
| 9 | Sternocleidomastoid muscle | 30 | Scapula (superior angle) |
| 10 | Lesser occipital nerve | 31 | Third rib |
| 11 | Longissimus capitis muscle (cut surface) | 32 | Second rib |
| 12 | Splenius cervicis muscle (cut surface) | 33 | First rib |
| 13 | Accessory nerve | 34 | Seventh cervical vertebra (spinous process) |
| 14 | Dorsal scapular nerve | 35 | Scalenus medius muscle |
| 15 | Transverse cervical artery | 36 | Iliocostalis cervicis muscle |
| 16 | Subclavian artery | 37 | Fourth cervical nerve (dorsal ramus) |
| 17 | Long thoracic nerve | 38 | Splenius capitis muscle |
| 18 | Transverse cervical artery (superficial branch) | 39 | Third occipital nerve |
| 19 | Accessory nerve | 40 | Semispinalis capitis muscle |
| 20 | Dorsal scapular nerve | | |
| 21 | Transverse cervical artery (deep branch)
[dorsal scapular artery] | | |



- | | | | |
|----|---|----|--|
| 1 | Trapezius muscle (transverse part) | 17 | Eighth rib (body) |
| 2 | Trapezius muscle (descending part) | 18 | Thoracic nerves
(lateral posterior cutaneous branches) |
| 3 | Rhomboideus major muscle | 19 | Thoracic nerves
(medial posterior cutaneous branches) |
| 4 | Spinous tubercle | 20 | Thyrolinguofacial trunk
(superficial layer [aponeurotic part]) |
| 5 | Infraspinatus muscle | 21 | Twelfth thoracic vertebra (spinous process) |
| 6 | Infraspinous fascia (cut edge) | 22 | Trapezius muscle (ascending part) |
| 7 | Deltoid muscle | 23 | Third thoracic nerve
(posterior cutaneous branch)
(supplies the third thoracic segment,
which HEAD describes as expanding laterally
and occupying almost all of the scapular region;
the lateral emergence is atypical) |
| 8 | Acromioclavicular joint | 24 | Third thoracic vertebra (spinous process) |
| 9 | Acromion | 25 | Seventh cervical vertebra (spinous process) |
| 10 | Scapular spine | | |
| 11 | Teres minor muscle | | |
| 12 | Teres major muscle | | |
| 13 | Scapula (medial border) | | |
| 14 | Thoracic nerves (lateral cutaneous branches) | | |
| 15 | Latissimus dorsi muscle | | |
| 16 | Intercostalis externus muscle
of seventh intercostal space
(covered by external intercostal fascia) | | |



Figure 65**Dorsum of the Thorax 2
Suprascapular Region 4**

- | | | | |
|----|--|----|--|
| 1 | Seventh cervical vertebra (spinous process) | 17 | Spinous tubercle |
| 2 | Trapezius muscle (descending part) | 18 | Accessory nerve |
| 3 | Rhomboideus minor muscle | 19 | Scapula (medial border) |
| 4 | Trapezius muscle (transverse part) | 20 | Deltoid muscle |
| 5 | Transverse cervical artery
(ascending branch of superficial branch) | 21 | Latissimus dorsi muscle |
| 6 | Transverse cervical artery
(descending branch of superficial branch) | 22 | Rhomboideus major muscle |
| 7 | Levator scapulae muscle (insertion) | 23 | Trapezius muscle (ascending part) |
| 8 | Transverse cervical artery
(suprascapular branch of superficial branch) | 24 | Rhomboideus major muscle |
| 9 | Scapula (superior border) | 25 | Third thoracic vertebra (spinous process) |
| 10 | Acromioclavicular joint | 26 | Trapezius muscle (cut edge) |
| 11 | Acromion | 27 | Transverse cervical artery (deep branch) |
| 12 | Transverse cervical artery (superficial branch) | 28 | Dorsal scapular nerve |
| 13 | Accessory nerve and descending branch
of superficial cervical artery | 29 | Scapula (superior angle) |
| 14 | Scapular spine | 30 | Transverse cervical artery (deep branch) |
| 15 | Supraspinatus muscle | 31 | Dorsal scapular nerve |
| 16 | Trapezius muscle
(insertion of transverse part, cut edge) | 32 | Levator scapulae muscle |
| | | 33 | Trapezius muscle (aberrant bundle) |
| | | 34 | Sternocleidomastoid muscle
with great auricular nerve |



Figure 66**Scapular Region**

- | | |
|---|---|
| 1 Rhomboideus major muscle | 21 Teres major muscle (tendon) |
| 2 Spinous tubercle | 22 Superior lateral cutaneous nerve of the arm |
| 3 Scapular spine | 23 Triceps brachii muscle (lateral head) |
| 4 Circumflex scapular artery | 24 Humerus (surgical neck) |
| 5 Teres major muscle | 25 Axillary nerve |
| 6 Acromion | 26 Posterior cutaneous nerve of the arm
(branch of radial nerve) |
| 7 Axillary nerve | 27 Axillary nerve (muscular branch to teres minor) |
| 8 Posterior circumflex humeral artery | 28 Teres major muscle |
| 9 Superior lateral cutaneous nerve of the arm | 29 Circumflex scapular artery |
| 10 Shaft of humerus | 30 Latissimus dorsi muscle |
| 11 Axillary nerve (perforating muscular branch) | 31 Teres minor muscle |
| 12 Deltoid muscle (spinous part) | 32 Infraspinous fascia (cut edge) |
| 13 Humerus (surgical neck)
and triceps brachii muscle (lateral head) | 33 Infraspinatus muscle |
| 14 Triceps muscle (long head) | 34 Latissimus dorsi muscle |
| 15 Teres major muscle (tendon) | 35 Teres minor muscle |
| 16 Axillary nerve (perforating muscular branch) | 36 Infraspinous fascia (cut edge) |
| 17 Deltoid muscle | 37 Infraspinatus muscle |
| 18 Axillary nerve (muscular branch) | 38 Scapula (medial border) |
| 19 Posterior circumflex humeral artery | 39 Trapezius muscle |
| 20 Triceps brachii muscle (long head) | |

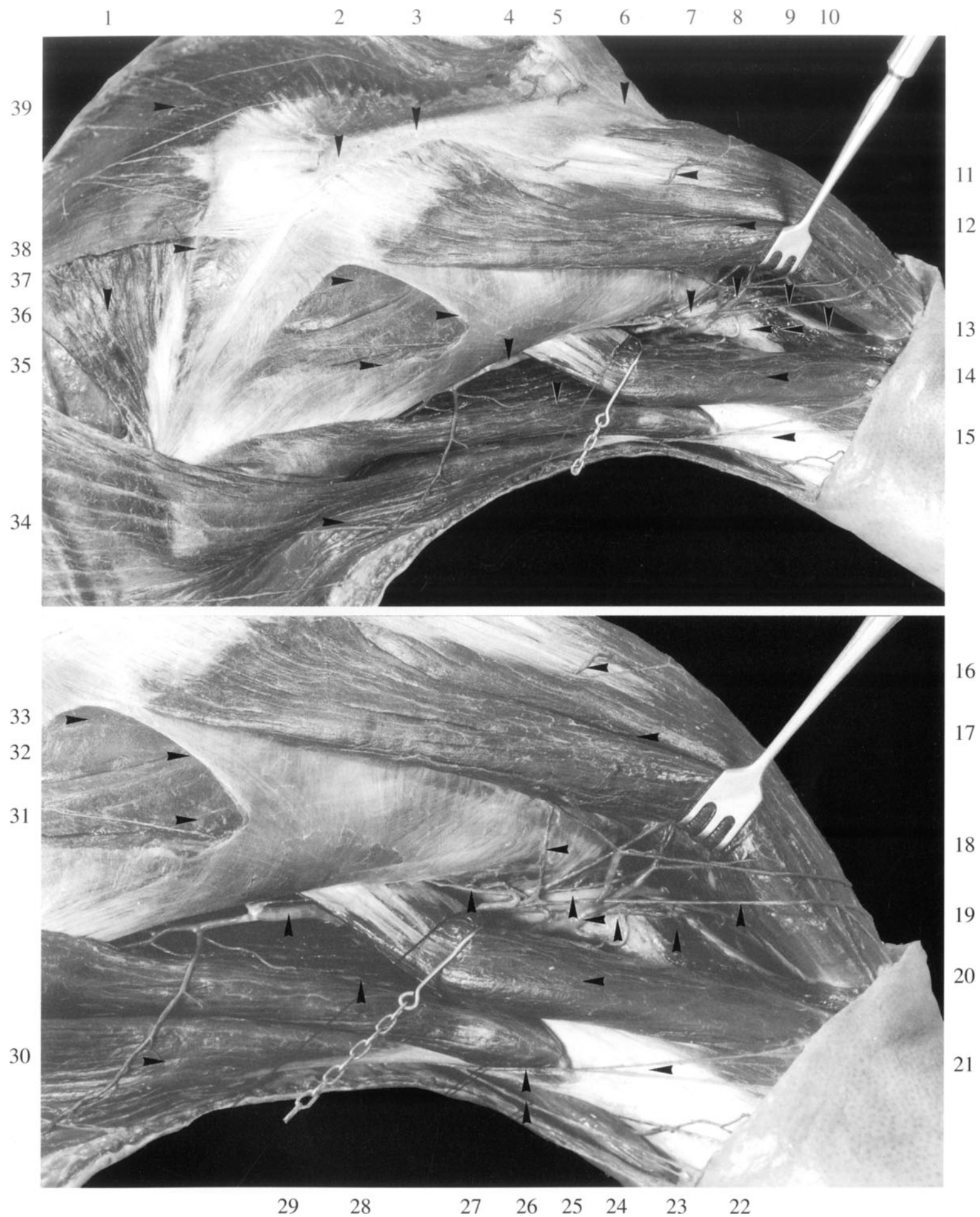


Figure 67

**Dorsum of the Thorax 3
Suprascapular Region 5
Interscapular Region 1**

- | | |
|--|---|
| 1 First thoracic nerve
(medial posterior cutaneous branch) | 16 Scapula (inferior angle) |
| 2 Rhomboideus minor muscle | 17 Latissimus dorsi muscle |
| 3 Levator scapulae muscle | 18 Sixth thoracic nerve
(lateral posterior cutaneous branch) |
| 4 Transverse cervical artery
(descending branch of superficial branch) | 19 Ninth thoracic nerve
(lateral posterior cutaneous branch) |
| 5 Scapula (spinous tubercle) | 20 Trapezius muscle |
| 6 Transverse cervical artery
(superficial branch) | 21 Eleventh thoracic vertebra (spinous process) |
| 7 Transverse cervical artery (deep branch) | 22 Eighth thoracic nerve
(medial posterior cutaneous branch) |
| 8 Accessory nerve | 23 Trapezius muscle (remnant of ascending part) |
| 9 Supraspinatus muscle | 24 Thoracolumbar fascia (superficial layer) |
| 10 Anastomotic branch to descending branch
of superficial cervical artery | 25 Sixth thoracic nerve
(lateral posterior cutaneous branch) |
| 11 Superficial branch of deep cervical artery | 26 Rhomboideus major muscle |
| 12 Infraspinous fascia | 27 Transverse cervical artery (deep branch) |
| 13 Scapula (medial border) | 28 Dorsal scapular nerve |
| 14 Teres major muscle | 29 Third thoracic vertebra (spinous process) |
| 15 Latissimus dorsi muscle
(inconstant scapular origin from inferior angle) | 30 Seventh cervical vertebra (spinous process) |

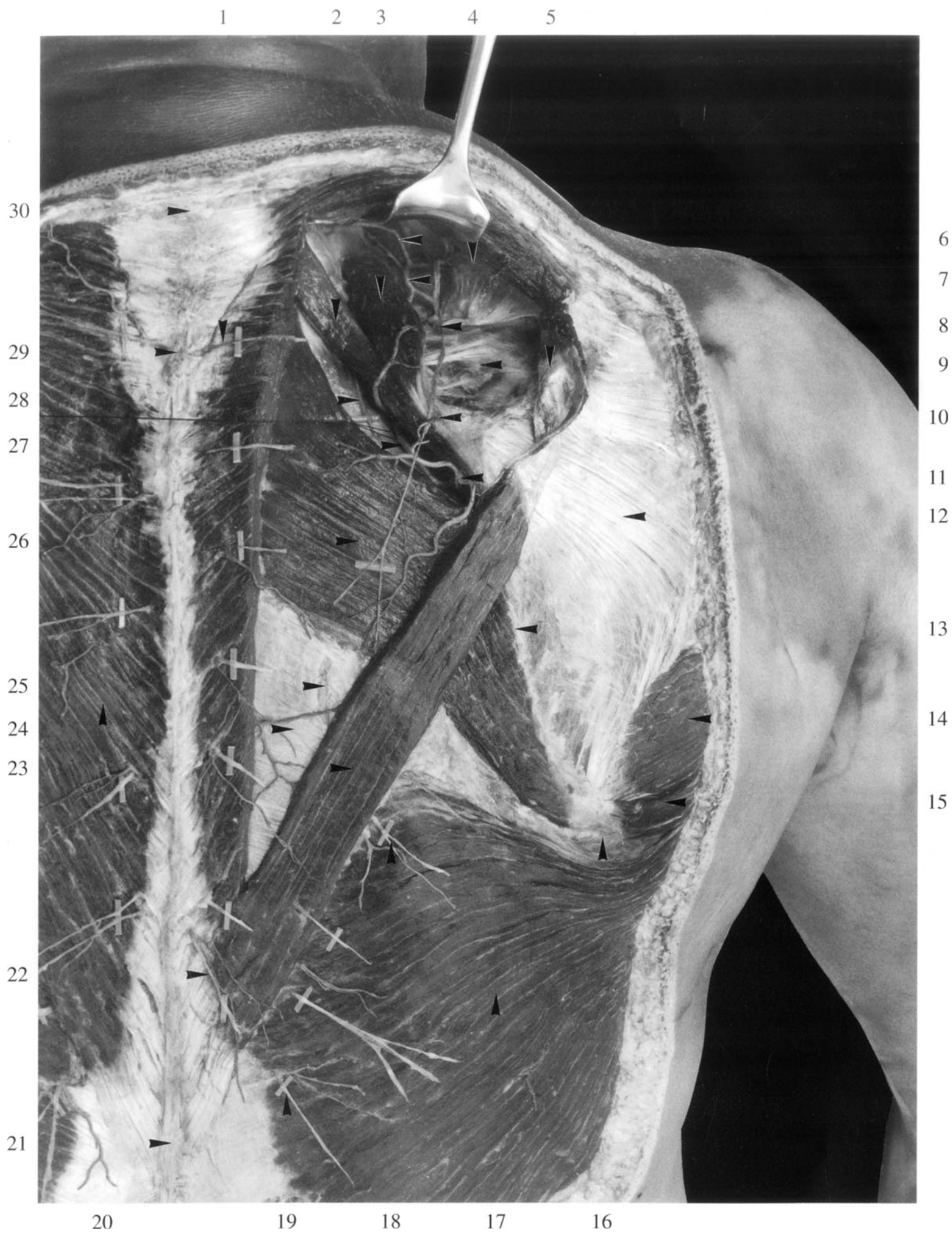


Figure 68

**Dorsum of the Thorax 4
Suprascapular Region 6
Interscapular Region 2**

- | | | | |
|----|--|----|--|
| 1 | Trapezius muscle | 19 | Latissimus dorsi muscle |
| 2 | Rhomboideus minor muscle (resected) | 20 | Seventh thoracic nerve
(lateral posterior cutaneous branch) |
| 3 | Levator scapulae muscle | 21 | Trapezius muscle |
| 4 | Accessory nerve | 22 | Tenth thoracic vertebra (spinous process) |
| 5 | Transverse cervical artery
(supraspinous branch of deep branch) | 23 | Eighth thoracic nerve
(medial posterior cutaneous branch) |
| 6 | Spinous tubercle | 24 | Seventh thoracic nerve
(medial posterior cutaneous branch) |
| 7 | Infraspinous fascia | 25 | Thoracolumbar fascia
(superficial layer [aponeurotic part]) |
| 8 | Transverse cervical artery (deep branch) | 26 | Trapezius muscle (cut edge) |
| 9 | Supraspinatus muscle | 27 | Iliocostalis muscle
(covered by thoracolumbar fascia) |
| 10 | Rhomboideus minor muscle (cut surface) | 28 | Anastomosis of deep branch
of transverse cervical artery
with posterior intercostal artery |
| 11 | Transverse cervical artery (deep branch) | 29 | Rhomboideus major muscle (cut edge) |
| 12 | Fourth rib | 30 | Serratus posterior superior muscle
(covered by thoracolumbar fascia) |
| 13 | Intercostalis externus muscle
(covered by external thoracic fascia) | 31 | Dorsal scapular nerve |
| 14 | Intercostalis externus muscle
of fifth intercostal space
(covered by external thoracic fascia) | 32 | Third thoracic vertebra (spinous process) |
| 15 | Teres major muscle | 33 | Transverse cervical artery (superficial branch) |
| 16 | Latissimus dorsi muscle
(inconstant scapular origin from inferior angle) | 34 | Seventh cervical vertebra (spinous process) |
| 17 | Seventh thoracic nerve
(medial posterior cutaneous branch) | | |
| 18 | Rhomboideus major muscle (cut surface) | | |



Figure 69

Dorsum of the Thorax 5
Posterior Cutaneous Branches 1

- | | |
|---|--|
| 1 First thoracic nerve
(medial posterior cutaneous branch) | 13 Tenth thoracic nerve
(lateral posterior cutaneous branch) |
| 2 Trapezius muscle | 14 Tenth thoracic nerve
(lateral posterior cutaneous branch) |
| 3 Rhomboideus major muscle | 15 Eleventh thoracic nerve
(lateral posterior cutaneous branch) |
| 4 Scapula (spinous tubercle) | 16 Posterior superior iliac spine |
| 5 Infraspinous fascia | 17 Fifth lumbar vertebra (spinous process) |
| 6 Scapula (medial border) | 18 Thoracolumbar fascia
(superficial layer [aponeurotic part]) |
| 7 Teres major muscle | 19 First lumbar vertebra (spinous process) |
| 8 Latissimus dorsi muscle
(inconstant scapular origin on inferior angle) | 20 Twelfth thoracic vertebra (spinous process) |
| 9 Sixth thoracic nerve
(lateral posterior cutaneous branch) | 21 Third thoracic nerve
(medial posterior cutaneous branch) |
| 10 Seventh thoracic nerve
(medial posterior cutaneous branch) | 22 Third thoracic vertebra (spinous process) |
| 11 Eighth thoracic nerve
(medial posterior cutaneous branch) | 23 First thoracic vertebra (spinous process) |
| 12 Latissimus dorsi muscle | |

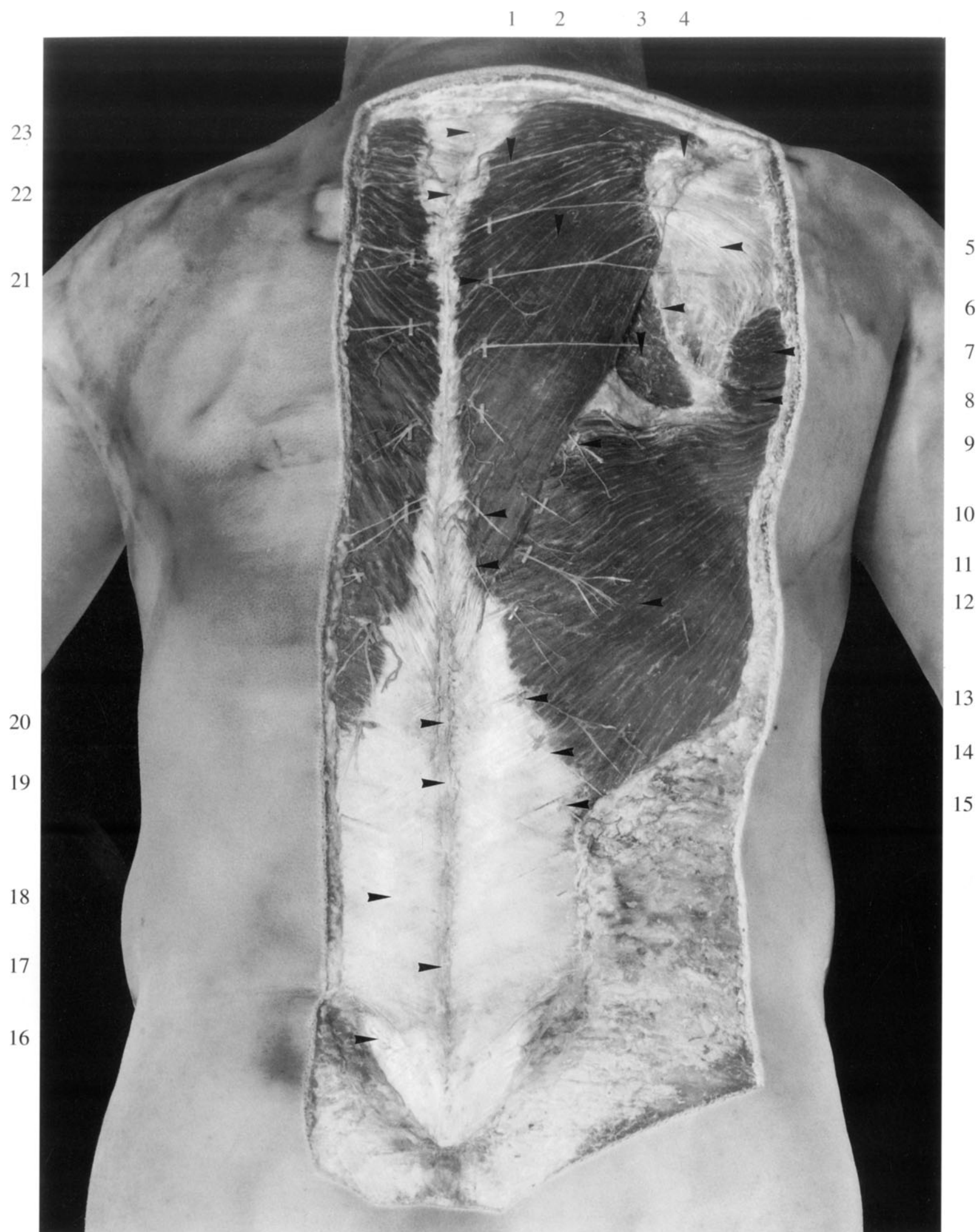


Figure 70

Dorsum of the Thorax 6
Posterior Cutaneous Branches 2

- | | | | |
|----|---|----|---|
| 1 | Serratus posterior superior muscle | 17 | Tenth thoracic nerve |
| 2 | Levator scapulae muscle | | (lateral posterior cutaneous branch) |
| 3 | Scapula (spinous tubercle) | 18 | Internal oblique muscle |
| 4 | Teres major muscle | 19 | Eleventh thoracic nerve |
| 5 | Trapezius muscle (cut surface) | | (lateral posterior cutaneous branch) |
| 6 | Transverse cervical artery (superficial branch) | 20 | Latissimus dorsi muscle |
| 7 | Accessory nerve | 21 | Serratus posterior inferior muscle |
| 8 | Dorsal scapular nerve | 22 | Iliocostalis muscle |
| 9 | Transverse cervical artery (deep branch) | 23 | Longissimus muscle |
| 10 | Infraspinous fascia | 24 | Posterior superior iliac spine |
| 11 | Rhomboideus major muscle (cut surface) | 25 | Thoracolumbar fascia |
| 12 | Sixth thoracic nerve | | (superficial layer [aponeurotic part]) |
| | (lateral posterior cutaneous branch) | 26 | Second lumbar vertebra (spinous process) |
| 13 | Latissimus dorsi muscle | 27 | Twelfth thoracic vertebra (spinous process) |
| | (inconstant scapular origin) | 28 | Ninth thoracic vertebra (spinous process) |
| 14 | Eighth thoracic nerve | 29 | Spinalis thoracis muscle |
| | (lateral posterior cutaneous branch) | 30 | Trapezius muscle |
| 15 | Ninth thoracic nerve | 31 | Splenius cervicis muscle |
| | (lateral posterior cutaneous branch) | 32 | Second thoracic vertebra (spinous process) |
| 16 | Eleventh rib | | |

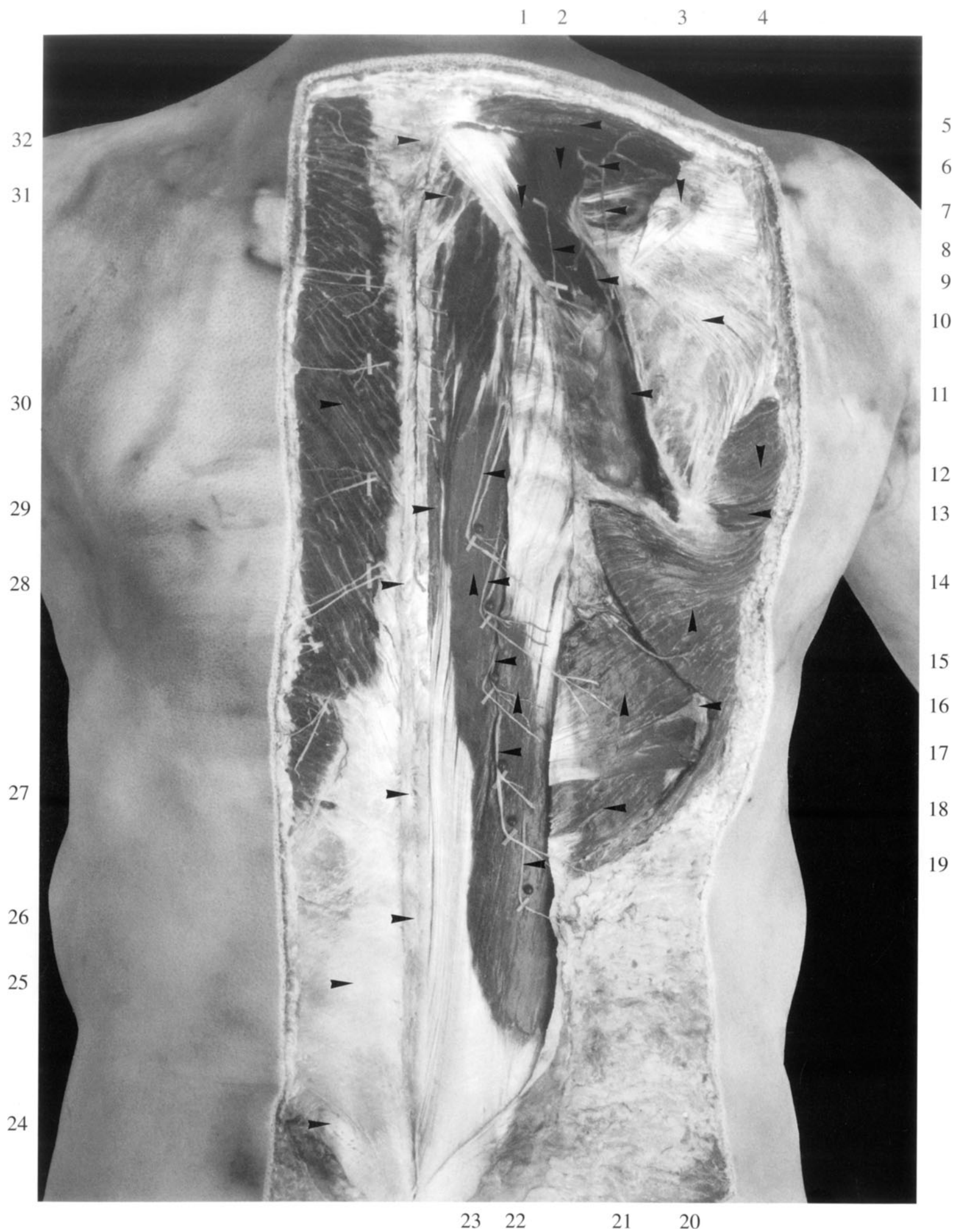


Figure 71

Dorsum of the Thorax 7
Posterior Cutaneous Branches 3

- | | | | |
|----|---|----|---|
| 1 | Scapular spine | 18 | Eleventh thoracic nerve
(lateral posterior cutaneous branch) |
| 2 | Serratus posterior superior muscle | 19 | Tenth thoracic nerve
(lateral posterior cutaneous branch) |
| 3 | Levator scapulae muscle | 20 | Twelfth thoracic nerve
(lateral branch of dorsal ramus) |
| 4 | Supraspinatus muscle | 21 | First lumbar nerve
(lateral branch of dorsal ramus) |
| 5 | Scapula (spinous tubercle) | 22 | Latissimus dorsi muscle |
| 6 | Infraspinous fascia | 23 | Serratus posterior inferior muscle |
| 7 | Teres major muscle | 24 | Internal oblique muscle |
| 8 | Trapezius muscle (cut surface) | 25 | Iliocostalis muscle |
| 9 | Transverse cervical artery (deep branch) | 26 | Longissimus muscle |
| 10 | Transverse cervical artery (deep branch) | 27 | Posterior superior iliac spine |
| 11 | Sixth rib and lateral costotransverse ligament | 28 | Fifth lumbar vertebra (spinous process) |
| 12 | Sixth thoracic nerve
(lateral posterior cutaneous branch) | 29 | Thoracolumbar fascia
(superficial layer [aponeurotic part]) |
| 13 | Seventh thoracic nerve
(with muscular branches
and no cutaneous branch) | 30 | Twelfth thoracic vertebra (spinous process) |
| 14 | Eighth thoracic nerve
(lateral posterior cutaneous branch) | 31 | Spinalis thoracis muscle |
| 15 | Tenth rib | 32 | Trapezius muscle |
| 16 | Ninth thoracic nerve
(lateral posterior cutaneous branch) | 33 | Splenius cervicis muscle |
| 17 | Tenth thoracic nerve
(lateral posterior cutaneous branch) | 34 | Second thoracic vertebra (spinous process) |

1

2

3

4

5

6

7

34

33

32

31

30

29

28

27

8

9

10

11

12

13

14

15

16

17

18

19

20

21

26

25

24

23

22

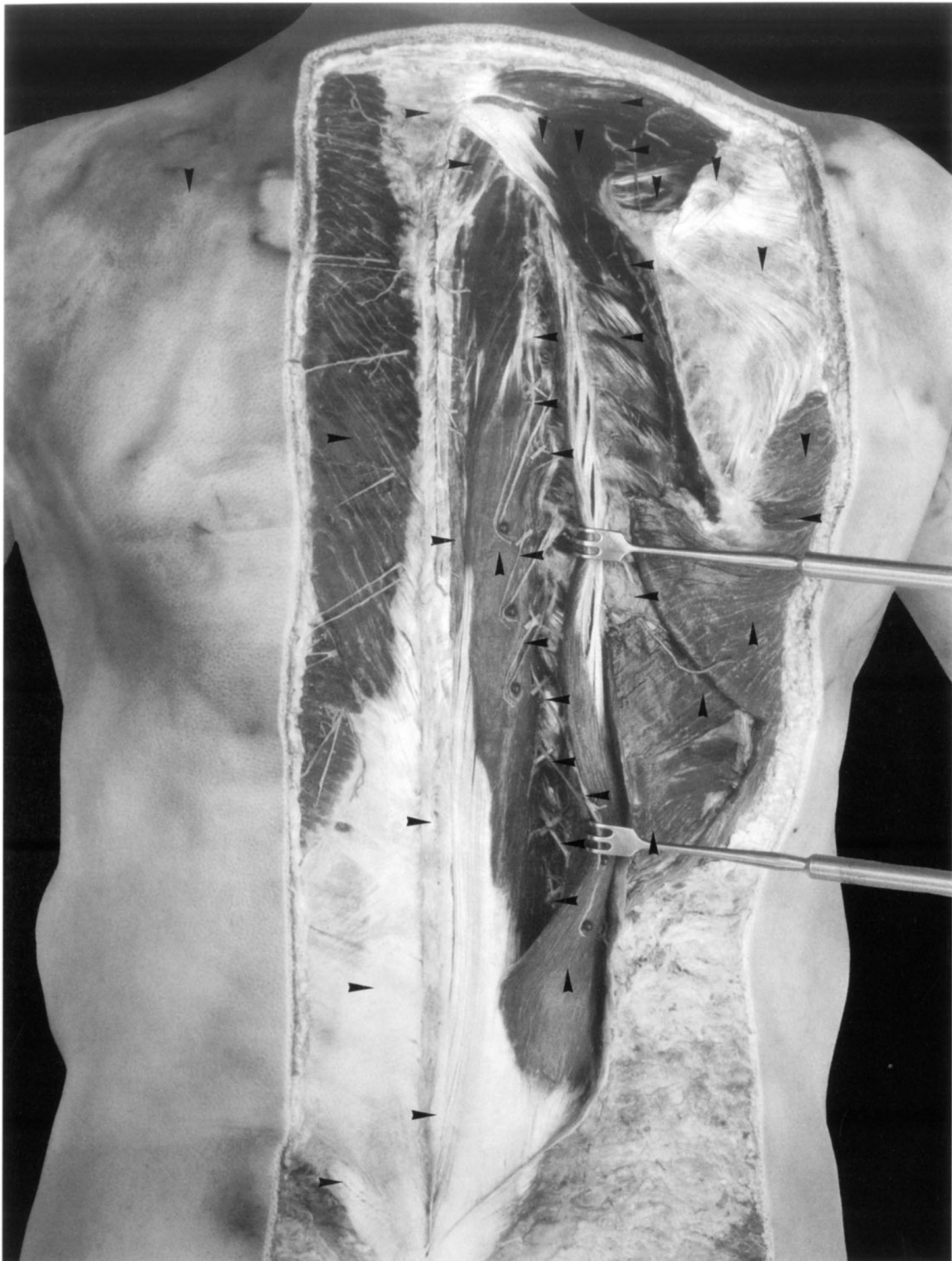


Figure 72

**Dorsum of the Thorax 8
Vertebrolumbar Region
Nerves and Arteries**

- | | | | |
|----|---|----|---|
| 1 | Longissimus muscle | 16 | Twelfth thoracic nerve |
| 2 | Longissimus muscle (tendon of insertion) | | (lateral posterior cutaneous branch) |
| 3 | Iliocostalis muscle | 17 | First lumbar nerve (superior clunial branch) |
| 4 | Angle of eighth rib | 18 | Second lumbar nerve (superior clunial branch) |
| 5 | Intercostalis externus muscle | 19 | External oblique muscle of abdomen |
| 6 | Levator costae brevis muscle | 20 | Iliac crest |
| 7 | Ninth thoracic nerve | 21 | Internal oblique muscle of abdomen |
| | (lateral posterior cutaneous branch) | 22 | Twelfth rib (body) |
| 8 | Tubercle of eleventh rib | 23 | Longissimus muscle (cut surface) |
| | with attachment of levator costae longus muscle | 24 | Fourth lumbar vertebra (spinous process) |
| 9 | Levator costae longus muscle | 25 | Third lumbar nerve (lateral posterior branch) |
| 10 | Tubercle of twelfth rib | 26 | Thoracolumbar fascia |
| | with attachment of levator costae longus muscle | | (superficial layer [aponeurotic part]) |
| 11 | Eleventh thoracic nerve | 27 | First lumbar nerve (lateral posterior branch) |
| | (lateral posterior cutaneous branch | 28 | First lumbar artery (posterior branch) |
| | with resected medial twig) | 29 | Twelfth thoracic vertebra (spinous process) |
| 12 | Iliocostalis muscle | 30 | Longissimus muscle (tendon) |
| 13 | Twelfth thoracic nerve | 31 | Tenth thoracic vertebra (spinous process) |
| | (lateral posterior cutaneous branch) | 32 | Spinalis thoracis muscle |
| 14 | Eleventh thoracic nerve | 33 | Eighth thoracic nerve |
| | (lateral posterior cutaneous branch) | | (lateral posterior cutaneous branch) |
| 15 | Thoracolumbar fascia | 34 | Tubercle of ninth rib |
| | (deep layer [lumbar aponeurosis]) | 35 | Lateral costotransverse ligament |

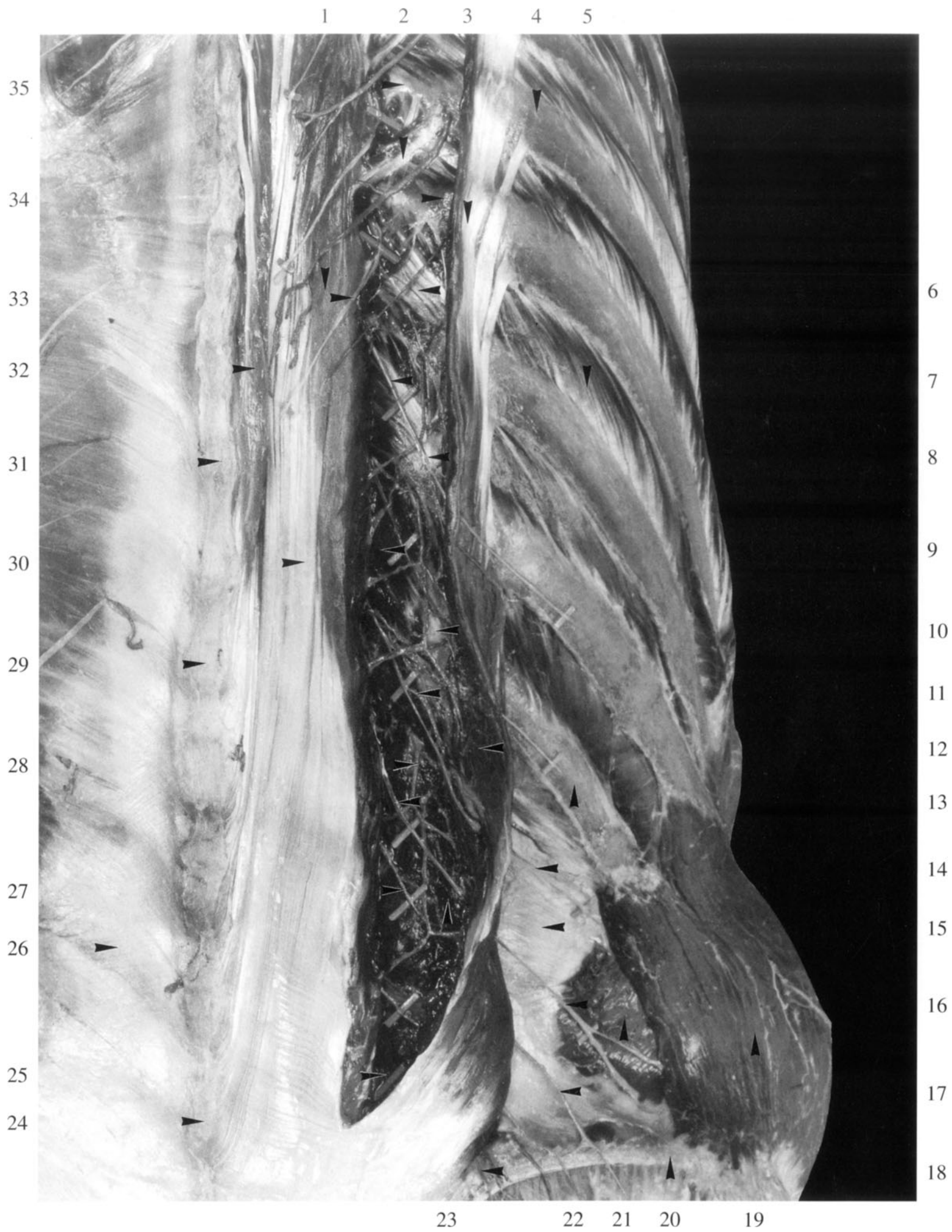


Figure 73**Dorsum of the Thorax 9
Posterior Branches of the Thoracic Nerves**

- | | | | |
|----|--|----|--|
| 1 | Lateral posterior cutaneous branch | 22 | Levator costae brevis muscle |
| 2 | Longissimus thoracis muscle | 23 | Posterior intercostal artery
(medial branch of dorsal branch) |
| 3 | Medial posterior cutaneous branch | 24 | Ninth thoracic nerve
(lateral branch of dorsal ramus) |
| 4 | Spinalis thoracis muscle | 25 | Levator costae brevis and longus muscles |
| 5 | Sixth thoracic nerve (dorsal ramus) | 26 | Ninth rib |
| 6 | Levator costae brevis muscle | 27 | Iliocostalis muscle |
| 7 | Internal intercostal membrane | 28 | Costal angle |
| 8 | Levator costae brevis muscles (cut surfaces) | 29 | Levator costae longus muscle |
| 9 | Muscular branch of posterior intercostal artery | 30 | Posterior intercostal artery
(medial branch of dorsal branch) |
| 10 | Lateral posterior cutaneous artery | 31 | Ninth thoracic nerve |
| 11 | Seventh thoracic nerve
(lateral posterior cutaneous branch) | 32 | Eleventh thoracic vertebra (spinous process) |
| 12 | Intercostalis externus muscle | 33 | Intertransverse muscle |
| 13 | Intercostalis externus muscle | 34 | Eleventh rib |
| 14 | Superior costotransverse ligament | 35 | Intertransverse ligament |
| 15 | Internal intercostal membrane | 36 | Intertransverse muscle |
| 16 | Superior costotransverse ligament | 37 | Eighth thoracic nerve (dorsal ramus) |
| 17 | Seventh thoracic nerve
(medial branch of dorsal ramus) | 38 | Lateral costotransverse ligament |
| 18 | Internal intercostal membrane | 39 | Seventh intercostal artery (dorsal branch) |
| 19 | Intercostalis externus muscle (resected) | 40 | Sixth thoracic vertebra (transverse process) |
| 20 | Levator costae muscle (resected) | 41 | Intertransverse ligament |
| 21 | Intercostalis externus muscle | | |



Figure 74 **Dorsum of the Thorax 10**
Intercostal Nerve
and Posterior Intercostal Artery

- | | |
|---|--|
| 1 Sixth thoracic nerve (dorsal ramus) | 23 Lateral posterior cutaneous arteries |
| 2 Seventh posterior intercostal artery (dorsal branch) | 24 Intercostalis externus muscle (resected) |
| 3 Neck of seventh rib | 25 Levator costae brevis muscle (cut surface) |
| 4 Internal intercostal membrane | 26 Ninth thoracic nerve (lateral branch of dorsal ramus) |
| 5 Levator costae brevis muscle (cut edge) | 27 Levator costae brevis muscle |
| 6 Seventh intercostal nerve | 28 Eighth thoracic nerve (lateral branch of dorsal ramus) |
| 7 Levator costae brevis muscle (cut edge) | 29 Ninth posterior intercostal artery (lateral branch of dorsal branch) |
| 8 Seventh intercostal nerve (muscular branch between intercostalis externus and intercostalis internus) | 30 Eighth intercostal artery (dorsal branch) |
| 9 Intercostalis internus muscle (resected) | 31 Ninth posterior intercostal nerve (medial branch of posterior branch) |
| 10 Intercostalis internus muscle (cut surface) | 32 Eighth intercostal nerve (medial branch of posterior branch) |
| 11 Lateral posterior cutaneous artery | 33 Posterior intercostal artery (medial branch of dorsal branch) |
| 12 Intercostalis externus muscle | 34 Ninth thoracic vertebra (transverse process) |
| 13 Superior costotransverse ligament | 35 Eighth intercostal nerve (posterior branch) |
| 14 Lateral costotransverse ligament | 36 Costotransverse ligament (cut surface) |
| 15 Parietal pleura | 37 Costotransverse ligament (cut surface) |
| 16 Intercostalis intimus muscle | 38 Posterior intercostal artery (muscular branch to erector spinae) |
| 17 Posterior intercostal artery (collateral branch [supracostal branch]) | 39 Posterior intercostal artery (dorsal branch) |
| 18 Internal intercostal membrane | 40 Fourth thoracic vertebra (spinous process) |
| 19 Superior costotransverse ligament | 41 Intertransverse ligament |
| 20 Intercostalis externus muscle | |
| 21 Intertransverse ligament | |
| 22 Eighth thoracic nerve (lateral cutaneous branch) | |

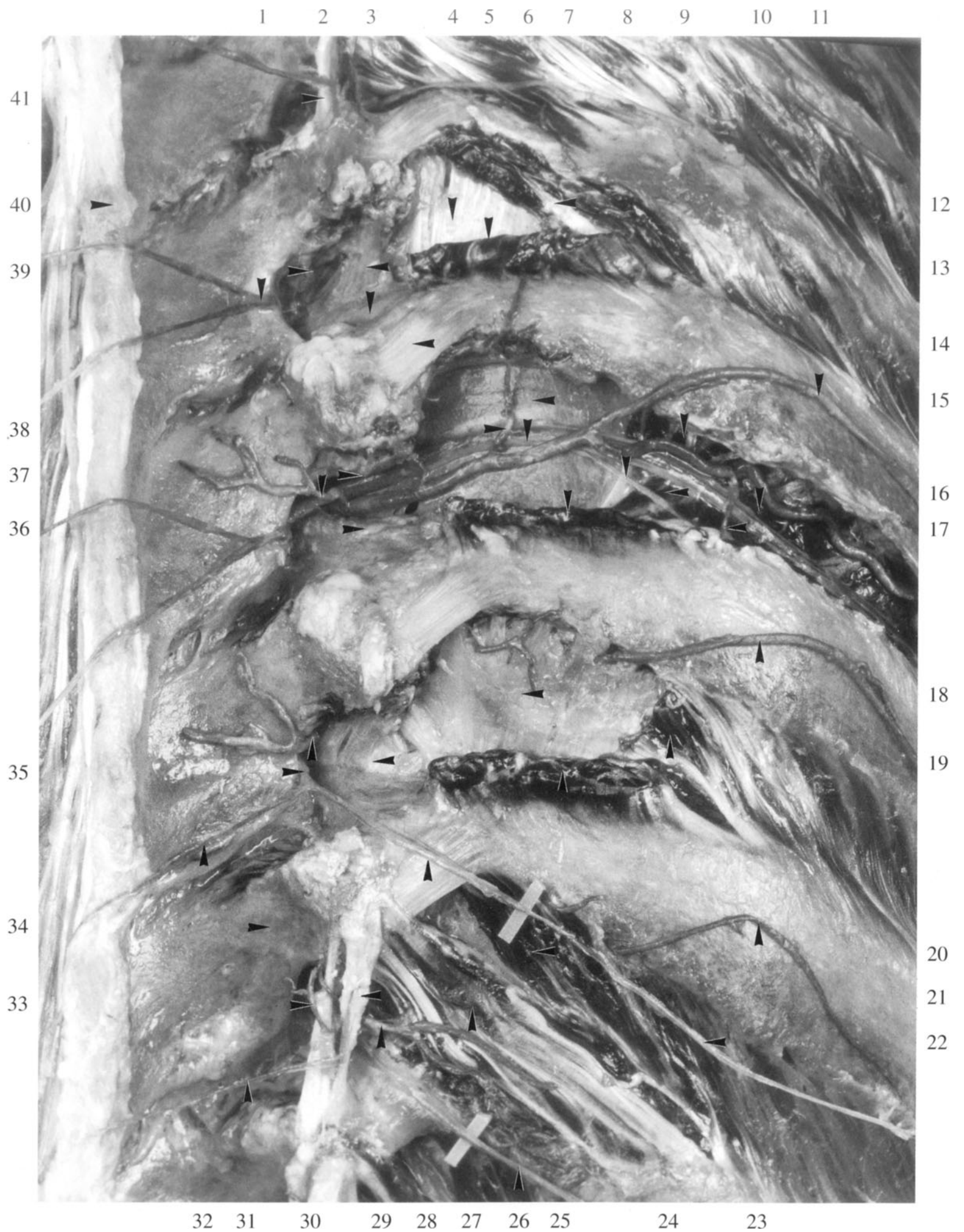


Figure 75 **Lumbar Puncture 1**
Lumbar Region

- | | |
|---|--|
| 1 Third lumbar vertebra (spinous process) | 22 Superior clunial branches |
| 2 Ligamentum flavum | 23 External oblique muscle |
| 3 First zygapophyseal articulation
(first vertebral articulation) | 24 Internal oblique muscle |
| 4 Intertransversarius lateralis lumborum muscle | 25 Iliac crest |
| 5 Psoas major muscle | 26 Iliolumbar ligament |
| 6 Thoracolumbar fascia
(deep layer [lumbar aponeurosis]) | 27 Fourth lumbar vertebra (costal process) |
| 7 Lumbocostal ligament | 28 Posterior superior iliac spine |
| 8 Twelfth rib | 29 First sacral nerve (dorsal ramus) |
| 9 First lumbar vertebra (costal process) | 30 Spinal dura mater |
| 10 Twelfth thoracic nerve
(lateral branch of dorsal ramus) | 31 Median sacral crest |
| 11 First lumbar artery | 32 Third lumbar nerve
(medial branch of dorsal ramus) |
| 12 Second lumbar vertebra (costal process) | 33 Articular cavity with cut edges of joint capsule
(L3–L4 zygapophyseal articulation) |
| 13 Second lumbar nerve
(distal to intervertebral foramen) | 34 Third lumbar vertebra
(origin of inferior articular process
from vertebral lamina) |
| 14 Lumbar plexus and lateral branch
of dorsal branch of second lumbar artery | 35 Dorsal ridge of superior articular process
(bounded laterally by intervertebral foramen) |
| 15 First lumbar nerve
(lateral branch of dorsal ramus) | 36 Third lumbar vertebra
(mamillary process
on superior articular process) |
| 16 Third lumbar vertebra (costal process) | 37 Second lumbar vertebra
(caudal margin of vertebral lamina) |
| 17 Intertransversarius medialis lumborum muscle
and intertransverse ligament | 38 First lumbar nerve
(medial branch of dorsal ramus) |
| 18 Intertransversarius lateralis lumborum muscle | 39 Ligamentum flavum
(inferior attachment to posterior surface
of vertebral lamina) |
| 19 Lumbar plexus
and dorsal branch of third lumbar artery | 40 Twelfth thoracic nerve
(medial branch of dorsal ramus) |
| 20 Third lumbar nerve
(lateral branch of dorsal ramus) | |
| 21 Thoracolumbar fascia
(attachment of superficial layer to deep layer) | |



- 1 Latissimus dorsi muscle
- 2 Trapezius muscle
- 3 Spinalis thoracis muscle
- 4 Longissimus thoracis muscle
- 5 Iliocostalis muscle
- 6 Serratus posterior inferior muscle
- 7 Latissimus dorsi muscle
- 8 Internal abdominal oblique muscle
- 9 Thoracolumbar fascia
(superficial layer [aponeurotic part])
- 10 Multifidus muscle (tendon)
- 11 Zygapophyseal articulation at L2–L3
(mamillary process)
- 12 Longissimus thoracis muscle
- 13 Zygapophyseal articulation at L3–L4
- 14 Zygapophyseal articulation at L4–L5
- 15 Lumbosacral articulation
- 16 Iliac crest
- 17 Posterior superior iliac spine
- 18 Posterior superior iliac spine
- 19 Spinal dura mater (cut edge)
- 20 Thoracolumbar fascia
(superficial layer [aponeurotic part])
- 21 Fourth lumbar vertebra
(spinous process, cut surface)
- 22 Interspinal ligament at L3–L4
- 23 Spinal dura mater (cut edge)
- 24 Cauda equina enclosed in spinal arachnoid
- 25 Filum terminale behind spinal arachnoid
- 26 Interspinal ligament at L1–L2
- 27 Conus medullaris enclosed in spinal arachnoid

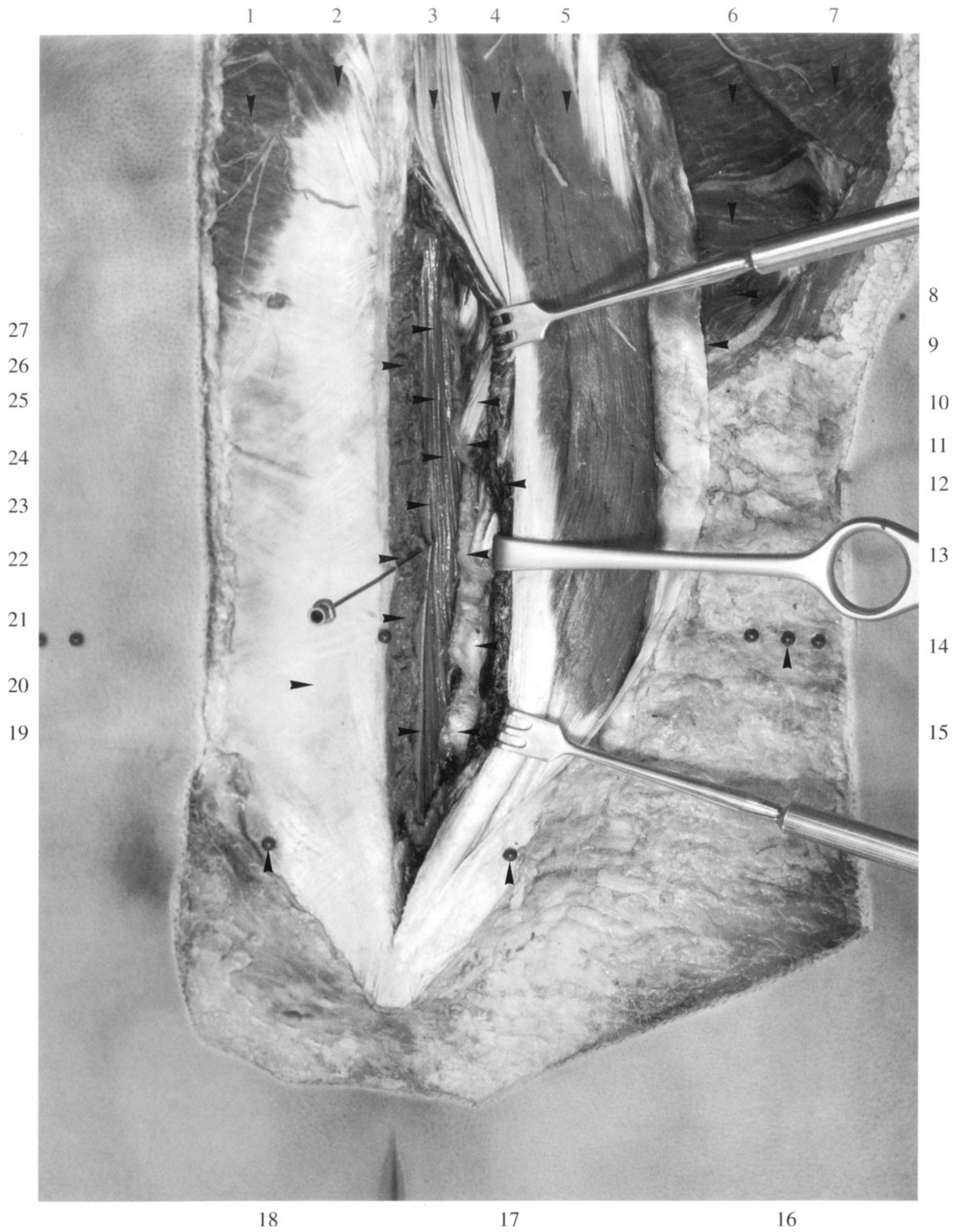


Figure 77

**Lumbar Region
Intervertebral Disk
and Spinal Nerve Root**

- | | | | |
|----|--|----|--|
| 1 | Latissimus dorsi muscle | 16 | Posterior root of fourth lumbar nerve with dural sheath |
| 2 | Trapezius muscle | 17 | Intervertebral disk at L5–S1 |
| 3 | Spinalis thoracis muscle | 18 | Posterior root of fifth lumbar nerve with dural sheath |
| 4 | Longissimus thoracis muscle | 19 | Spinal dura mater |
| 5 | Iliocostalis muscle | 20 | Lamina of fifth lumbar vertebra (reduced on both sides) |
| 6 | Serratus posterior inferior muscle | 21 | Spinal dura mater |
| 7 | Latissimus dorsi muscle | 22 | Lamina of fourth lumbar vertebra (reduced from below) |
| 8 | Tenth thoracic nerve (lateral posterior cutaneous branch) | 23 | Ligamentum flavum (cut edge) |
| 9 | Internal oblique muscle | 24 | Thoracolumbar fascia (superficial layer [aponeurotic part]) |
| 10 | Multifidus muscle (tendon) | 25 | Ligamentum flavum (inferior attachment to posterior surface of lamina) |
| 11 | Longissimus thoracis muscle | 26 | Lamina of second lumbar vertebra |
| 12 | Third lumbar vertebra (inferior border of lamina) | 27 | Ligamentum flavum |
| 13 | Zygapophyseal articulation (vertebral articulation) at L3–L4 (mamillary process) | 28 | First lumbar vertebra (spinous process) |
| 14 | Thoracolumbar fascia (superficial layer [aponeurotic part], cut surface) | | |
| 15 | Zygapophyseal articulation (vertebral articulation) at L4–L5 | | |

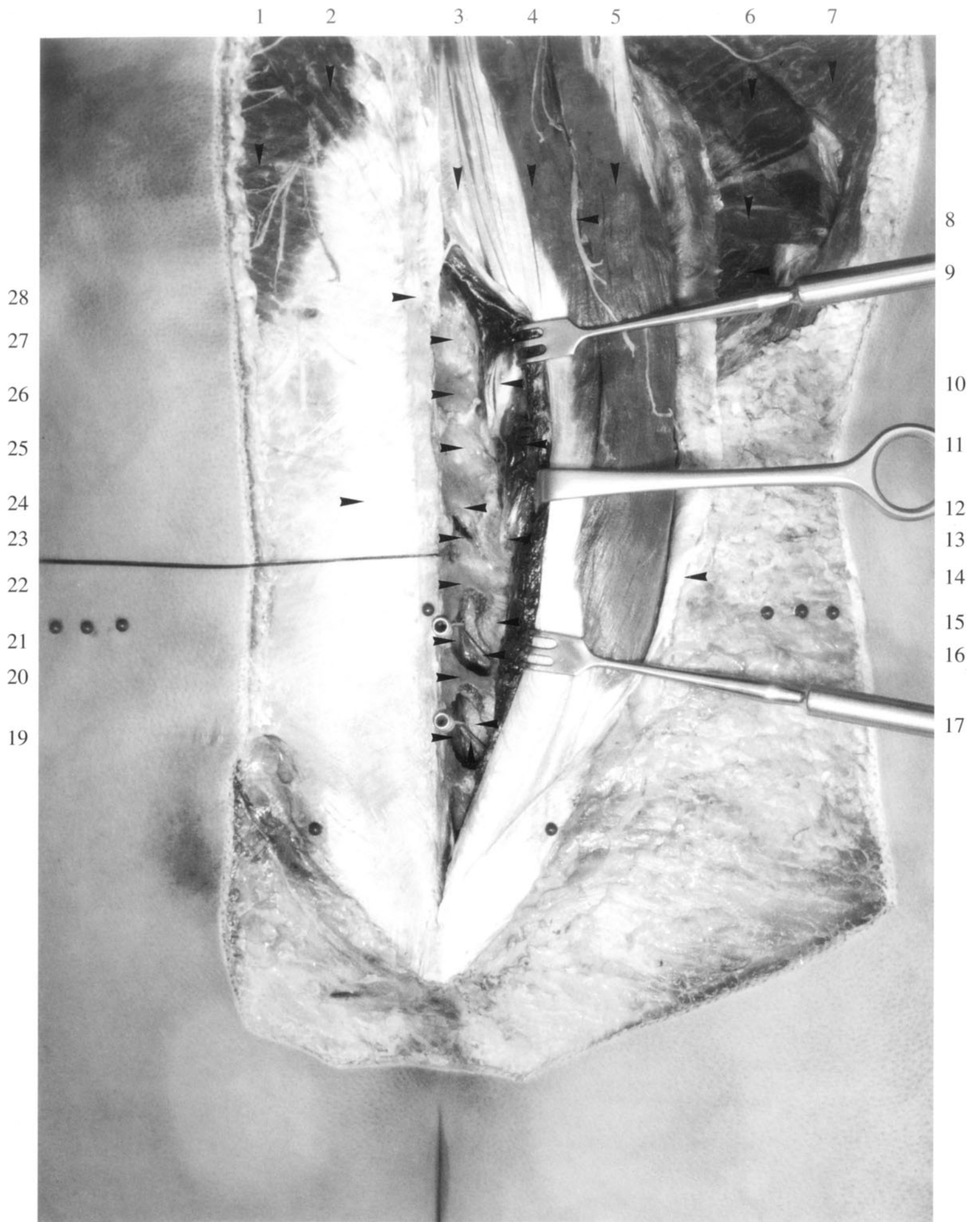


Figure 78

**Pectoral Region 1
Subcutaneous Fat**

- | | | | |
|----|--|----|---|
| 1 | Posterior axillary fold | 11 | Costal arch |
| 2 | Anterior axillary fold | | with anchoring structures of retinacula cutis |
| 3 | Clavicle | 12 | Infrasternal angle |
| 4 | Sternocleidomastoid muscle | 13 | Anchoring structure of retinaculum cutis |
| | with lesser supraclavicular fossa | | (longitudinally oriented) |
| 5 | Jugular fossa | | with emerging side branches |
| 6 | Clavicle | | of a cutaneous artery |
| 7 | Anchoring structures of retinacula cutis | 14 | Dense aggregation of retinacula cutis |
| | (longitudinally oriented) | | in front of lateral rectus sheath |
| 8 | Anchoring structure of retinacula cutis | 15 | Retinacula cutis |
| | (longitudinally oriented) | | (predominantly transversely oriented) |
| | with transected vascular branchlets | 16 | Nipple |
| 9 | Anchoring structure of retinaculum cutis | 17 | Retinacula cutis |
| | of sternum | | (predominantly transversely oriented) |
| 10 | Anchoring structures of retinacula cutis | 18 | Axillary fossa |
| | (longitudinally and transversely oriented) | 19 | Infraclavicular fossa |
| | with embedded side branches | 20 | Depression between top of shoulder joint |
| | of a cutaneous vessel | | and head of humerus |
| | | | (with the humerus subluxated) |

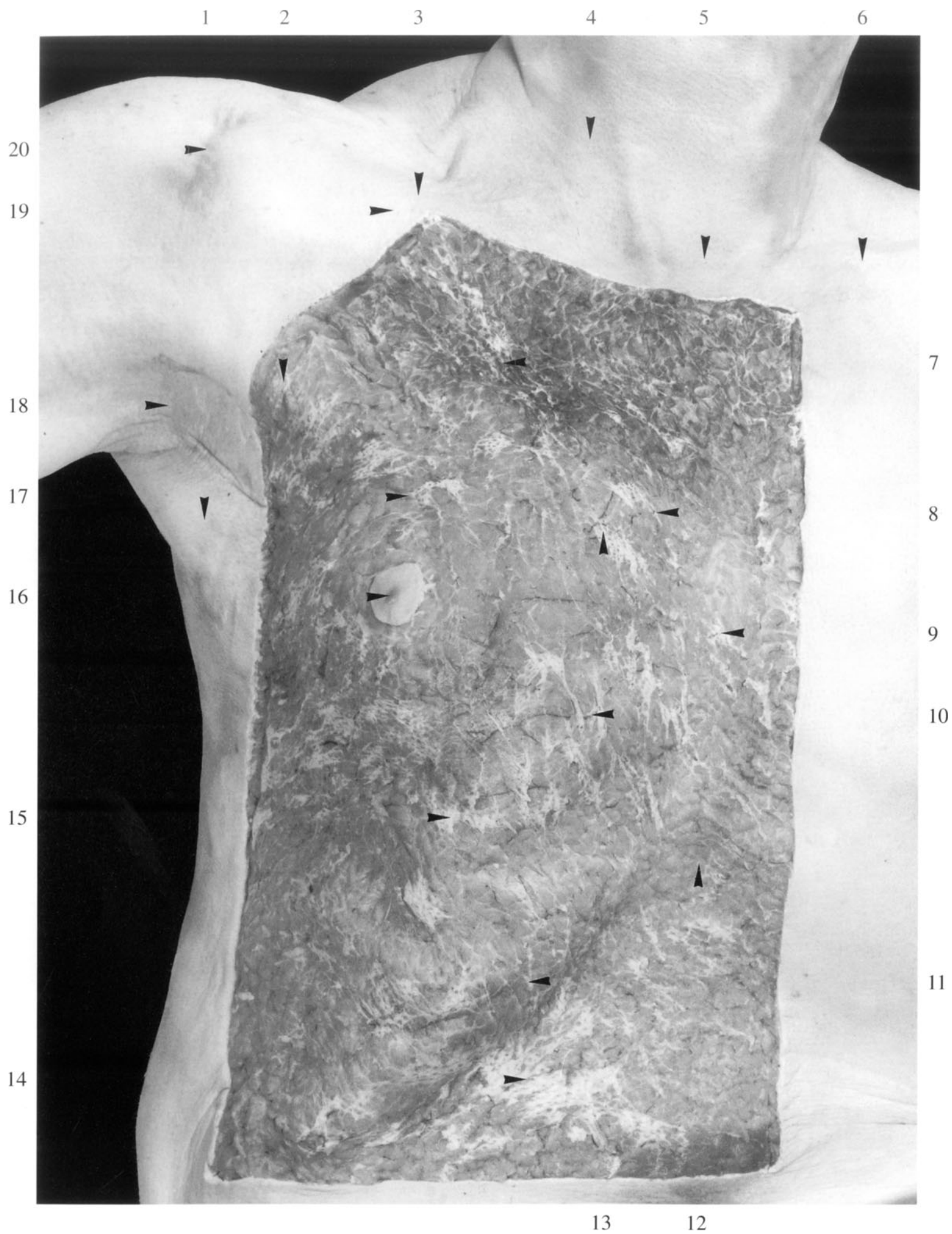


Figure 79**Pectoral Region 2
Superficial Pectoral Fascia**

- | | | | |
|----|--|----|--|
| 1 | Anterior axillary fold | 18 | Superficial superior epigastric artery
(of MANCHOT) |
| 2 | Axillary fossa | 19 | Linea alba (of abdomen) |
| 3 | Clavicle | 20 | Rectus sheath |
| 4 | Superficial pectoral fascia (cut edge) | 21 | Internal thoracic artery (perforating branch) |
| 5 | Greater supraclavicular fossa
with bulge of omohyoid muscle | 22 | External oblique muscle
covered by superficial pectoral fascia |
| 6 | Internal thoracic artery (perforating branch) | 23 | External oblique muscle
covered by superficial pectoral fascia |
| 7 | Jugular fossa | 24 | External oblique muscle
covered by superficial pectoral fascia |
| 8 | Sternum between origins
of pectoralis major muscles | 25 | Deep layer of stratum subcutaneum |
| 9 | Sternocleidomastoid muscle
with lesser supraclavicular fossa | 26 | Costal arch |
| 10 | Pectoralis major muscle covered by fascia
and deep layer of stratum subcutaneum | 27 | Bulge of fifth rib |
| 11 | Internal thoracic artery (perforating branch) | 28 | Bulge of fourth rib |
| 12 | Internal thoracic artery (perforating branch) | 29 | Nipple |
| 13 | Internal thoracic artery (perforating branch) | 30 | Deep layer of stratum subcutaneum |
| 14 | Xiphoid process
with sternal branches of internal thoracic artery | 31 | Pectoralis major muscle |
| 15 | Internal thoracic artery (perforating branch) | 32 | Anterior axillary fold |
| 16 | Bulge of costal cartilage of sixth rib | 33 | Depression between top of shoulder joint
and head of humerus
(with the humerus subluxated) |
| 17 | Superficial superior epigastric artery
(of MANCHOT) (sixth perforating branch
of internal thoracic artery) | | |



Figure 80**Pectoral Region 3
Musculature**

- | | |
|--|---|
| 1 Subcutaneous tissue with deep layer of stratum subcutaneum and superficial pectoral fascia (cut surface) | 17 Superficial pectoral fascia and deep layer of stratum subcutaneum |
| 2 Clavicle | 18 Sixth intercostal nerve (anterior branch of lateral cutaneous branch) |
| 3 Pectoralis major muscle (clavicular part) | 19 External oblique muscle (slip arising from seventh rib) |
| 4 Clavicle | 20 Sixth intercostal nerve (posterior branch of lateral cutaneous branch) |
| 5 Sternocleidomastoid muscle (tendon of origin of sternal head) | 21 External oblique muscle (slip arising from eighth rib) |
| 6 Sternal end of clavicle | 22 External oblique muscle (slip arising from sixth rib) |
| 7 Pectoralis major muscle (sternocostal part) | 23 Sixth intercostal space |
| 8 Nipple | 24 Serratus anterior muscle (slip arising from sixth rib) |
| 9 Sternal membrane | 25 Subcutaneous tissue |
| 10 Pectoralis major muscle (lateral border of sternocostal part) | 26 Deep layer of stratum subcutaneum |
| 11 Sixth costal cartilage | 27 Axillary fat |
| 12 Pectoralis major muscle (abdominal part) | 28 Posterior axillary fold |
| 13 Costal arch | 29 Axillary fossa |
| 14 Rectus sheath (covered by deep layer of stratum subcutaneum) | 30 Anterior axillary fold |
| 15 Subcutaneous tissue | 31 Infraclavicular fossa |
| 16 Rectus abdominis muscle | |



Figure 81 **Pectoral Region 4**
Musculature

- | | | | |
|----|---|----|--|
| 1 | Trapezius muscle | 16 | Sixth intercostal space |
| 2 | Clavicle | 17 | Costochondral joint |
| 3 | Greater supraclavicular fossa | 18 | Sixth costal cartilage |
| 4 | Lesser supraclavicular fossa | 19 | Costal arch |
| 5 | Sternoclavicular joint | 20 | Radiate sternocostal ligament |
| 6 | Jugular fossa | | for sternocostal joint of seventh costal cartilage |
| 7 | Clavicle (sternal end) | 21 | Rectus sheath (upper border of anterior layer) |
| 8 | Pectoralis major muscle (clavicular part) | 22 | Bulge of fourth rib |
| 9 | Omohyoid muscle | 23 | Bulge of seventh rib |
| | in greater supraclavicular fossa | 24 | Bulge of sixth rib |
| 10 | Clavicle | 25 | Rectus abdominis muscle |
| 11 | Deltoideopectoral sulcus | | (tendon or origin) |
| 12 | Sternocleidomastoid muscle | 26 | Fifth intercostal space |
| | (tendon of sternal head) | 27 | Bulge of fifth costal cartilage |
| 13 | Sternal angle | 28 | Nipple |
| 14 | Sternal membrane | 29 | Bulge of third rib |
| 15 | Costoxiphoid ligament | 30 | Bulge of second costal cartilage |
| | | 31 | Infraclavicular fossa |

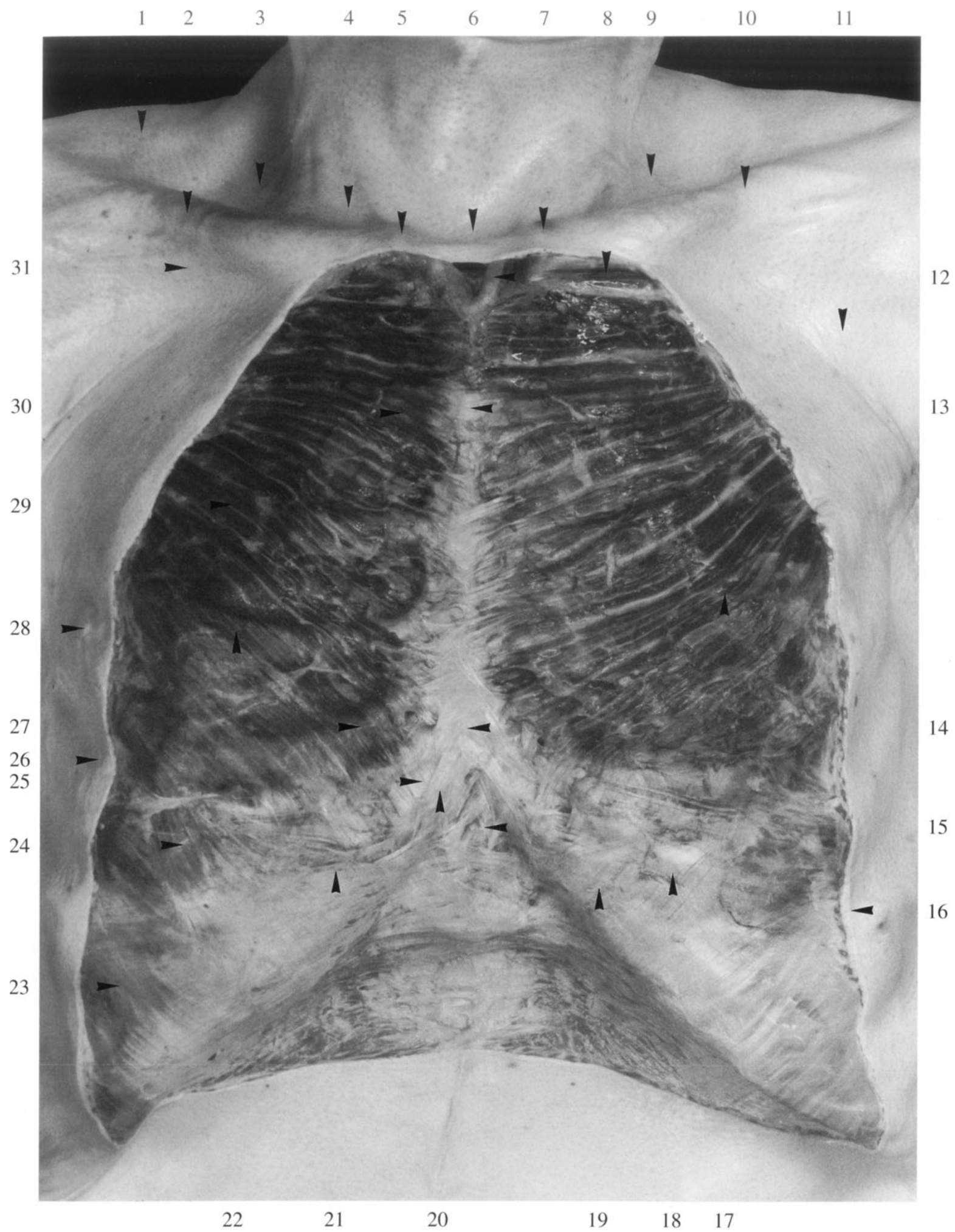


Figure 82 **Pectoral Region 5**
Male Breast

- | | | | |
|----|--|----|---|
| 1 | Retinaculum cutis (cut edge) | 15 | Costal arch |
| 2 | Subcutaneous tissue (cut surface) | 16 | Internal thoracic artery
(third perforating branch,
medial mammary branch) |
| 3 | Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) | 17 | Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) |
| 4 | Retinaculum cutis (at its origin
from deep layer of stratum subcutaneum) | 18 | Retinaculum cutis (cut edge) |
| 5 | Subcutaneous tissue (cut surface) | 19 | Superficial pectoral fascia (floor of flat tunnel) |
| 6 | Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) | 20 | Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) |
| 7 | Skin (cut edge) | 21 | Areola |
| 8 | Subcutaneous tissue (cut surface) | 22 | Nipple |
| 9 | Infraclavicular fossa | 23 | Deep layer of stratum subcutaneum
with origin of a retinaculum cutis |
| 10 | Deep layer of stratum subcutaneum | 24 | Internal thoracic artery
(second perforating branch,
medial mammary branch) |
| 11 | Internal thoracic artery
(first perforating branch) | 25 | Retinaculum cutis
(at its origin from deep layer
of stratum subcutaneum) |
| 12 | Skin (cut edge) | | |
| 13 | Skin of areola (cut edge) | | |
| 14 | Areola (cut surface
of subcutaneous connective tissue layer,
which is devoid of fat) | | |

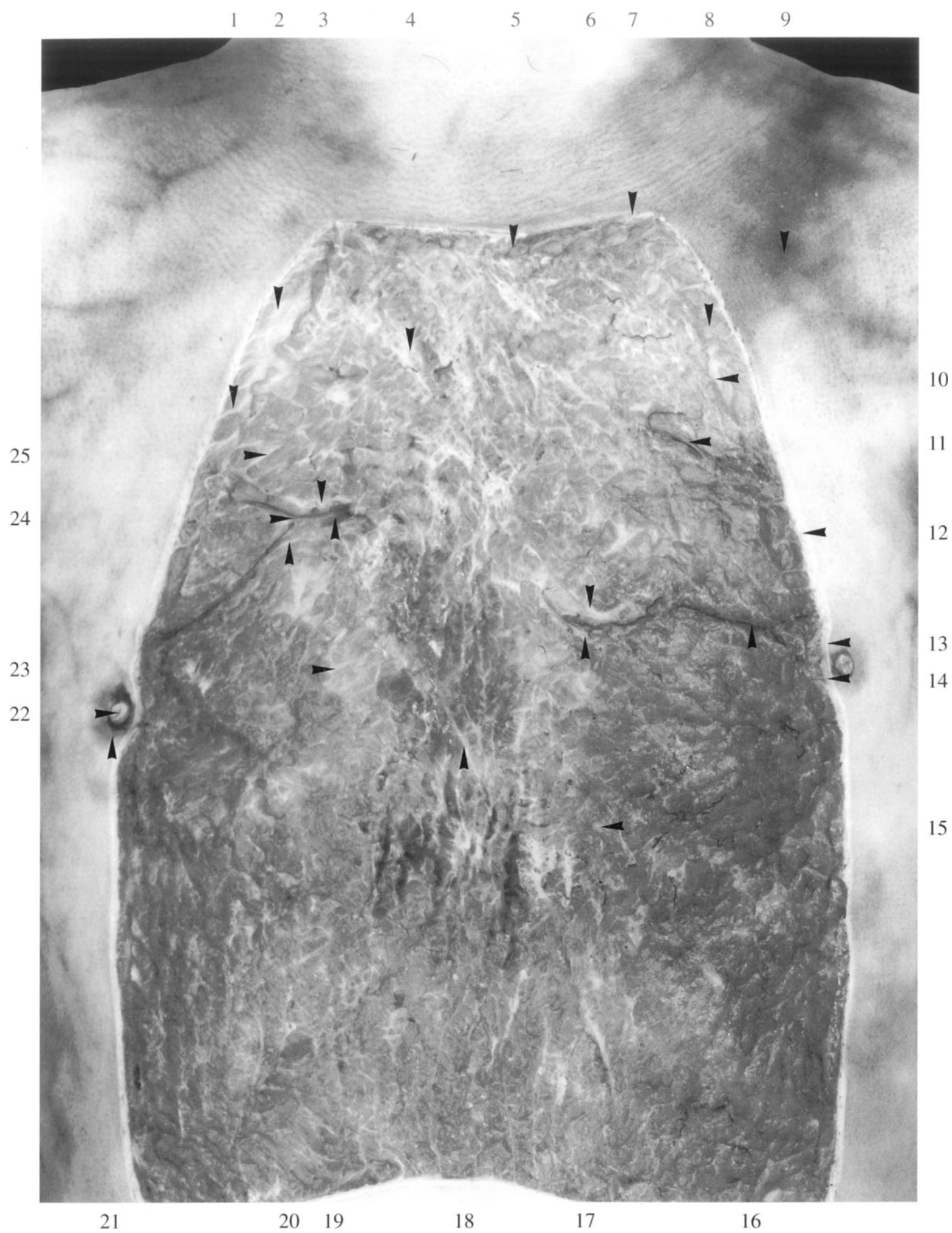


Figure 83**Pectoral Region 6
Mammary Branches and Subcutaneous Tissue
Sternal Membrane**

- | | |
|--|--|
| 1 Medial supraclavicular nerve | 20 Deep layer of stratum subcutaneum |
| 2 Sternocleidomastoid muscle (sternal head) | 21 Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) |
| 3 Subcutaneous tissue | 22 Superior epigastric artery (cutaneous branch) |
| 4 Platysma | 23 Radiate sternocostal ligament
of seventh sternocostal joint |
| 5 Deep layer of stratum subcutaneum
(roof of flat tunnel, cut edge) | 24 Rectus sheath (upper border) |
| 6 Internal thoracic artery
(first perforating branch, embedded in deep layer
of stratum subcutaneum) | 25 Pectoralis major muscle (abdominal part) |
| 7 Subcutaneous tissue (cut surface) | 26 Areola |
| 8 Skin (cut surface) | 27 Rectus sheath |
| 9 Deep layer of stratum subcutaneum | 28 Linea alba |
| 10 Subcutaneous tissue (cut surface) | 29 External oblique muscle |
| 11 Internal thoracic artery
(third perforating branch,
medial mammary branch) | 30 Subcutaneous tissue (cut surface) |
| 12 Skin of areola (cut edge) | 31 Costoxiphoid ligament |
| 13 Posterior intercostal artery
(lateral mammary branch) | 32 Costoxiphoid ligament |
| 14 Internal thoracic artery (perforating branch) | 33 Fifth intercostal nerve
(anterior cutaneous branch) |
| 15 Superior epigastric artery (cutaneous branch) | 34 Nipple |
| 16 External oblique muscle | 35 Sternal membrane |
| 17 Seventh posterior intercostal artery
(anterior cutaneous branch) | 36 Pectoralis major muscle (sternocostal part) |
| 18 Eighth posterior intercostal artery
(anterior cutaneous branch) | 37 Internal thoracic artery
(second perforating branch,
medial mammary branch) |
| 19 Subcutaneous fascia
with embedded medial mammary branch | 38 Sternal membrane in front of sternal angle |
| | 39 First intercostal nerve
(anterior cutaneous branch) |
| | 40 Internal thoracic artery
(first perforating branch) |

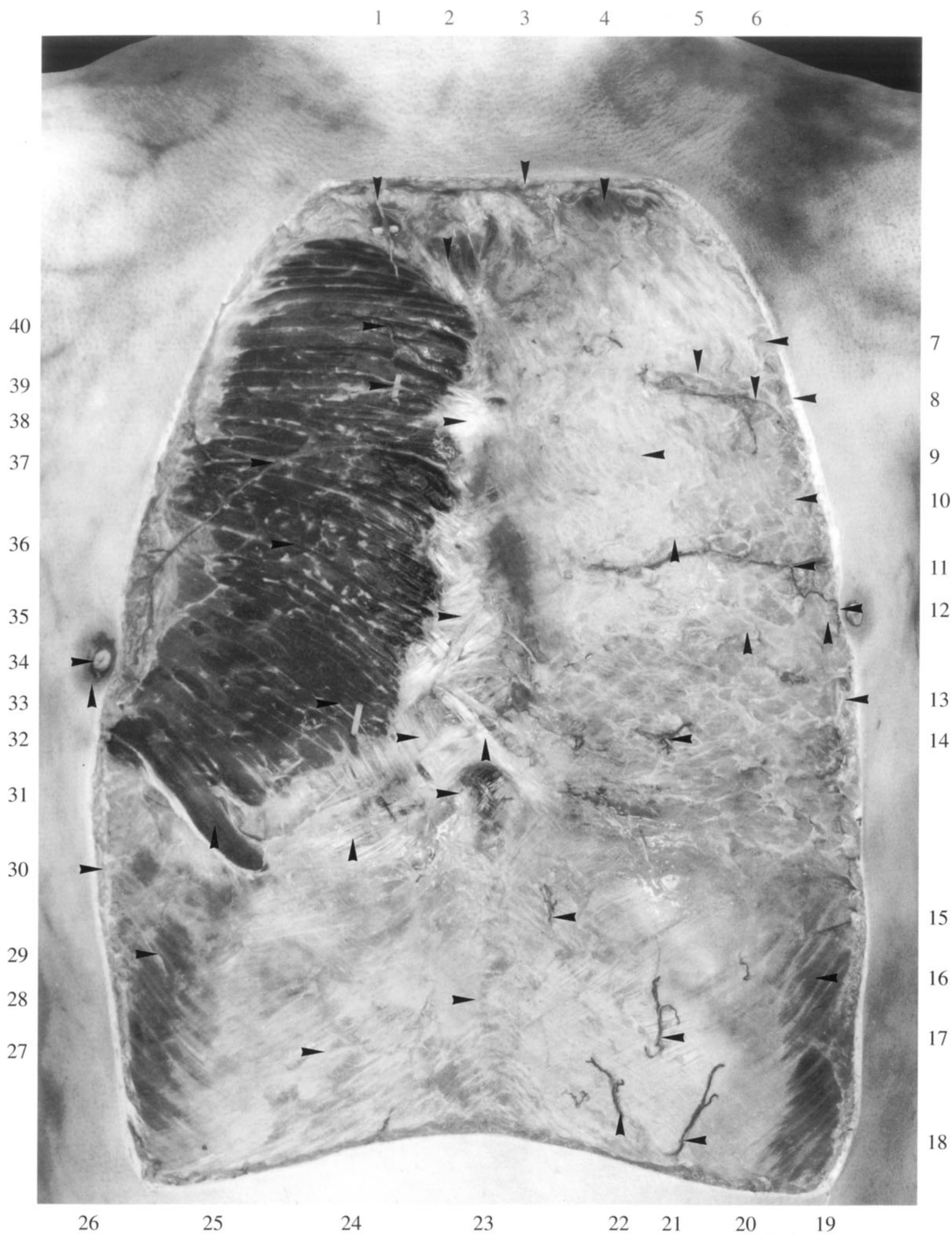


Figure 84**Pectoral Region 7
Anterior Cutaneous Branches of Intercostal Nerves**

- | | |
|---|---------------------------------------|
| 1 Pectoralis major muscle (sternocostal part) | 25 Pectoralis major muscle |
| 2 Sternocleidomastoid muscle (sternal belly) | (variant: separate costal origins) |
| 3 Manubrium sterni | 26 Third posterior intercostal artery |
| 4 Sternocostal synchondrosis of first rib | (lateral mammary branch) |
| 5 Internal intercostal muscle | 27 Internal thoracic artery |
| 6 External intercostal muscle | (third perforating branch, |
| 7 Pectoralis minor muscle | medial mammary branch) |
| (covered by clavipectoral fascia) | 28 Radiate sternocostal ligaments |
| 8 Pectoralis minor muscle | 29 Sternal membrane |
| (covered by clavipectoral fascia) | 30 Rectus abdominis tendon sheath |
| 9 Areola | (anterior layer) |
| 10 Anterior axillary fold | 31 Costoxiphoid ligaments |
| 11 First rib | 32 Fifth intercostal nerve |
| 12 Internal intercostal muscle | (anterior cutaneous branches) |
| 13 Internal thoracic artery | and perforating branch |
| (first perforating branch) | 33 Radiate sternocostal ligaments |
| 14 Pectoralis major muscle (cut surface) | 34 Fifth costal cartilage |
| 15 External intercostal membrane | 35 Fourth costal cartilage |
| 16 Internal thoracic artery | 36 Third intercostal nerve |
| (second perforating branch) | (anterior cutaneous branch, |
| 17 External intercostal membrane | medial mammary branch) |
| 18 Internal intercostal muscle | 37 Internal intercostal muscle |
| 19 Costochondral joint of fourth rib | 38 Sternocostal joint of third rib |
| 20 Fourth posterior intercostal artery | 39 Second intercostal nerve |
| (lateral mammary branch) | (anterior cutaneous branch, |
| 21 External oblique muscle | medial mammary branch) |
| 22 Rectus abdominis muscle (cut surface) | 40 First intercostal nerve |
| 23 External oblique muscle | (anterior cutaneous branch) |
| 24 Nipple | 41 First intercostal nerve |
| | (anterior cutaneous branch) |

1 2 3 4 5 6 7 8 9 10



Figure 85

Pectoral Region 8
Internal Thoracic Artery

- | | | | |
|----|--|----|---|
| 1 | Internal intercostal muscle | 22 | Costal arch |
| 2 | Internal thoracic artery (perforating branch) | 23 | Parasternal lymph node |
| 3 | Internal thoracic artery
(anterior intercostal branch) | 24 | Third intercostal nerve
(anterior cutaneous branch) |
| 4 | Parasternal lymph node | 25 | Rectus sheath (anterior layer) |
| 5 | Sternal angle | 26 | Transversus thoracis muscle |
| 6 | Parietal pleura | 27 | Internal thoracic artery (perforating branch) |
| 7 | Internal thoracic vein | 28 | Rectus sheath (anterior layer, upper margin) |
| 8 | Internal intercostal muscle | 29 | Rectus abdominis muscle
(covered by superficial pectoral fascia) |
| 9 | External intercostal muscle | 30 | Costoxiphoid ligaments |
| 10 | External intercostal muscle | 31 | Internal intercostal muscle |
| 11 | First intercostal nerve
(anterior cutaneous branch) | 32 | Fourth costal cartilage |
| 12 | Internal thoracic artery | 33 | Internal thoracic artery (perforating branch) |
| 13 | Parasternal lymph node | 34 | Parasternal lymph node |
| 14 | Parasternal lymph node
(next to internal thoracic vein) | 35 | Internal thoracic artery
(perforating branch
with origin of sternal branch) |
| 15 | Internal intercostal muscle | 36 | Transversus thoracis muscle |
| 16 | Parasternal lymph node | 37 | Parietal pleura |
| 17 | Internal thoracic artery
with accompanying veins | 38 | Internal thoracic artery and vein |
| 18 | Parasternal lymph node | 39 | Second intercostal nerve
(anterior cutaneous branch) |
| 19 | Fourth rib (costochondral joint) | 40 | First rib (sternocostal joint of first rib) |
| 20 | Internal intercostal muscle | | |
| 21 | Sixth costal cartilage | | |

1 2 3 4 5 6 7 8 9 10

40

39

38

37

36

35

34

33

32

31

30

11

12

13

14

15

16

17

18

19

20

21

29

28

27

26

25

24

23

22

Figure 86 **Female Breast 1**
Location and Structure

- | | | | |
|----|---|----|--|
| 1 | Deltoid muscle | 13 | Subcutaneous tissue |
| 2 | Internal thoracic artery
(first perforating branch,
superficial cutaneous branch) | | with horizontally oriented retinaculum cutis |
| 3 | Thoracoacromial artery
(thoracic cutaneous branch) | 14 | Internal thoracic artery
(medial mammary branch,
superficial cutaneous branch) |
| 4 | Greater supraclavicular fossa | 15 | Breast with horizontally oriented retinacula cutis |
| 5 | Sternocleidomastoid muscle | 16 | Mamillary branch below areola |
| 6 | Trapezius muscle | 17 | Breast
(with fat pads between fibrous expansions
entering the skin) |
| 7 | Clavicle | 18 | Subcutaneous connective tissue of areola |
| 8 | Infraclavicular fossa | 19 | Internal thoracic artery
(medial mammary branch,
superficial cutaneous branch) |
| 9 | Jugular fossa | 20 | Posterior axillary fold |
| 10 | Internal thoracic artery
(first perforating branch,
superficial cutaneous branch) | 21 | Axillary fossa |
| 11 | Subcutaneous tissue with retinacula cutis | 22 | Anterior axillary fold |
| 12 | Nipple | | |

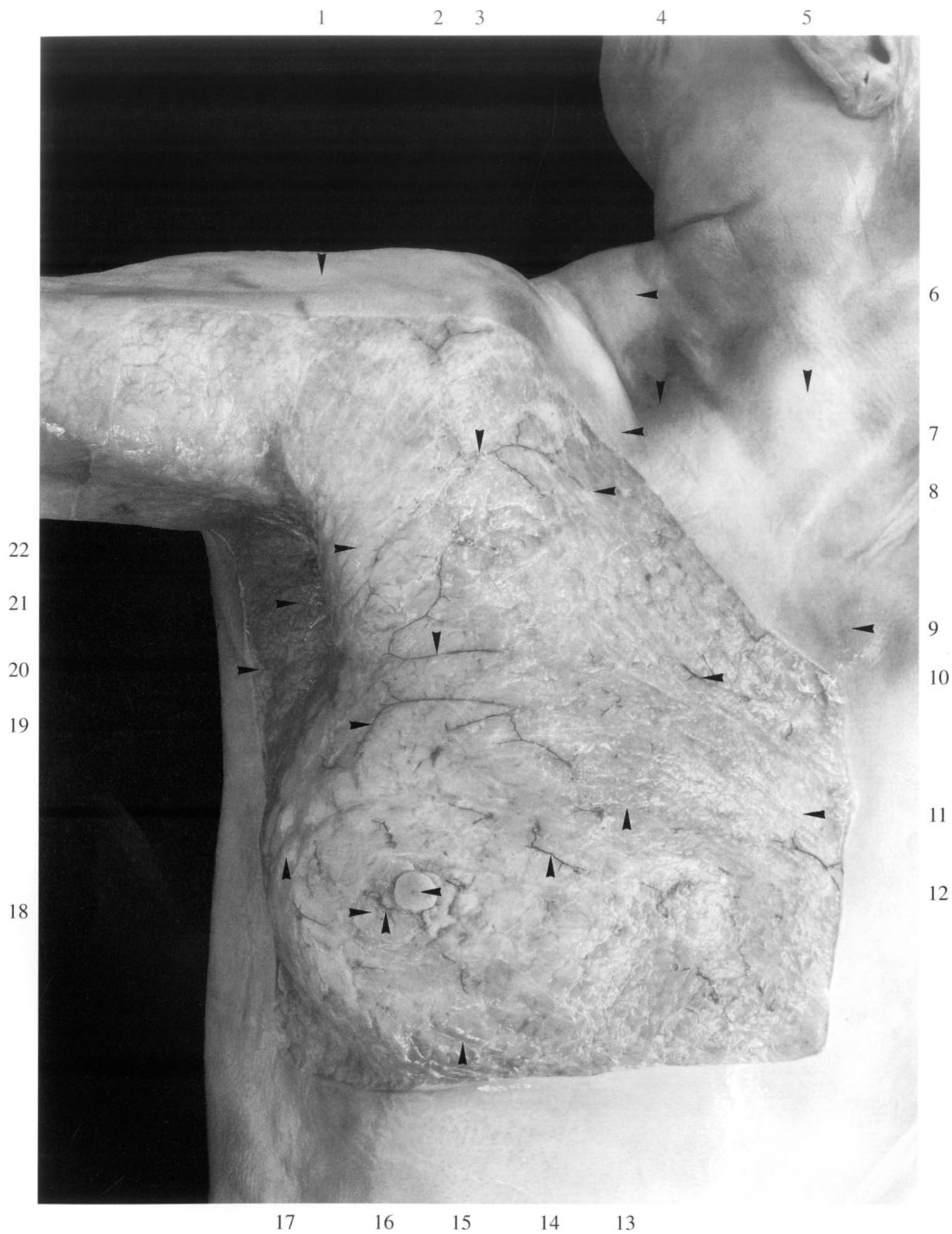


Figure 87

**Female Breast 2
Structure and Vascular Supply**

- | | | | |
|----|--|----|--|
| 1 | Lateral bicipital sulcus | 15 | Medial mammary branch
of second perforating branch |
| 2 | Deltoid muscle | 16 | Subcutaneous tissue (cut edge) |
| 3 | Thoracoacromial artery
(thoracic cutaneous branch) | 17 | Breast (parenchyma) |
| 4 | Infraclavicular fossa | 18 | Mammary branches
of superficial thoracic artery
(of MANCHOT) |
| 5 | Clavicle | 19 | Breast
(bridge of parenchyma
overlapping vascular ring) |
| 6 | Sternocleidomastoid muscle | 20 | Subcutaneous tissue (cut edge) |
| 7 | Greater supraclavicular fossa | 21 | Subcutaneous connective tissue of areola |
| 8 | Anastomosis between thoracoacromial artery
and first perforating branch | 22 | Nipple |
| 9 | Pectoralis major muscle | 23 | Circulus arteriosus of breast |
| 10 | Internal thoracic artery
(second perforating branch) | 24 | Subcutaneous tissue (cut edge) |
| 11 | Fourth posterior intercostal artery
(lateral mammary branch) | 25 | Anastomosis between first
and second perforating branches |
| 12 | Anastomosis between lateral mammary branch
and superficial thoracic artery (of MANCHOT) | 26 | Posterior axillary fold |
| 13 | Internal thoracic artery
(third perforating branch) | 27 | Axillary fossa |
| 14 | Internal thoracic artery
(first perforating branch) | 28 | Anterior axillary fold |

1

2

3

4

5

6

7

8

9

10

11

12

28

27

26

25

24

23

22

21

20

19

18

17

16

15

14

13

Figure 88

**Female Breast 3
Vascular Supply**

- | | | | |
|----|--|----|--|
| 1 | Medial bicipital sulcus | 17 | Breast |
| 2 | Lateral bicipital sulcus | | (fatty tissue, cut surface with retinaculum cutis) |
| 3 | Deltoid muscle | 18 | Internal thoracic artery |
| 4 | Anterior axillary fold | | (third perforating branch) |
| 5 | Thoracoacromial artery | 19 | Medial mammary branch |
| | (thoracic cutaneous branch) | | of second perforating branch |
| 6 | Internal thoracic artery | 20 | Nipple |
| | (first perforating branch) | 21 | Breast (parenchyma) |
| 7 | Clavicle | 22 | Mammary branch of superficial thoracic artery |
| 8 | Trapezius muscle | | (of MANCHOT) |
| 9 | Sternocleidomastoid muscle | 23 | Anastomosis between mammary branches |
| 10 | Greater supraclavicular fossa | | of superficial thoracic artery (of MANCHOT) |
| 11 | Infraclavicular fossa | 24 | Subcutaneous connective tissue of areola |
| 12 | Anastomosis between thoracoacromial artery | | with blood vessels for areola and nipple |
| | and first perforating branch | 25 | Superficial thoracic artery (of MANCHOT) |
| 13 | Jugular fossa | 26 | Breast |
| 14 | Circulus arteriosus of breast | | (fatty tissue, cut surface with retinaculum cutis) |
| 15 | Internal thoracic artery | 27 | Anastomosis between first |
| | (second perforating branch) | | and second perforating branches |
| 16 | Mamillary branch of lateral mammary branch | 28 | Posterior axillary fold |
| | | 30 | Axillary fossa |

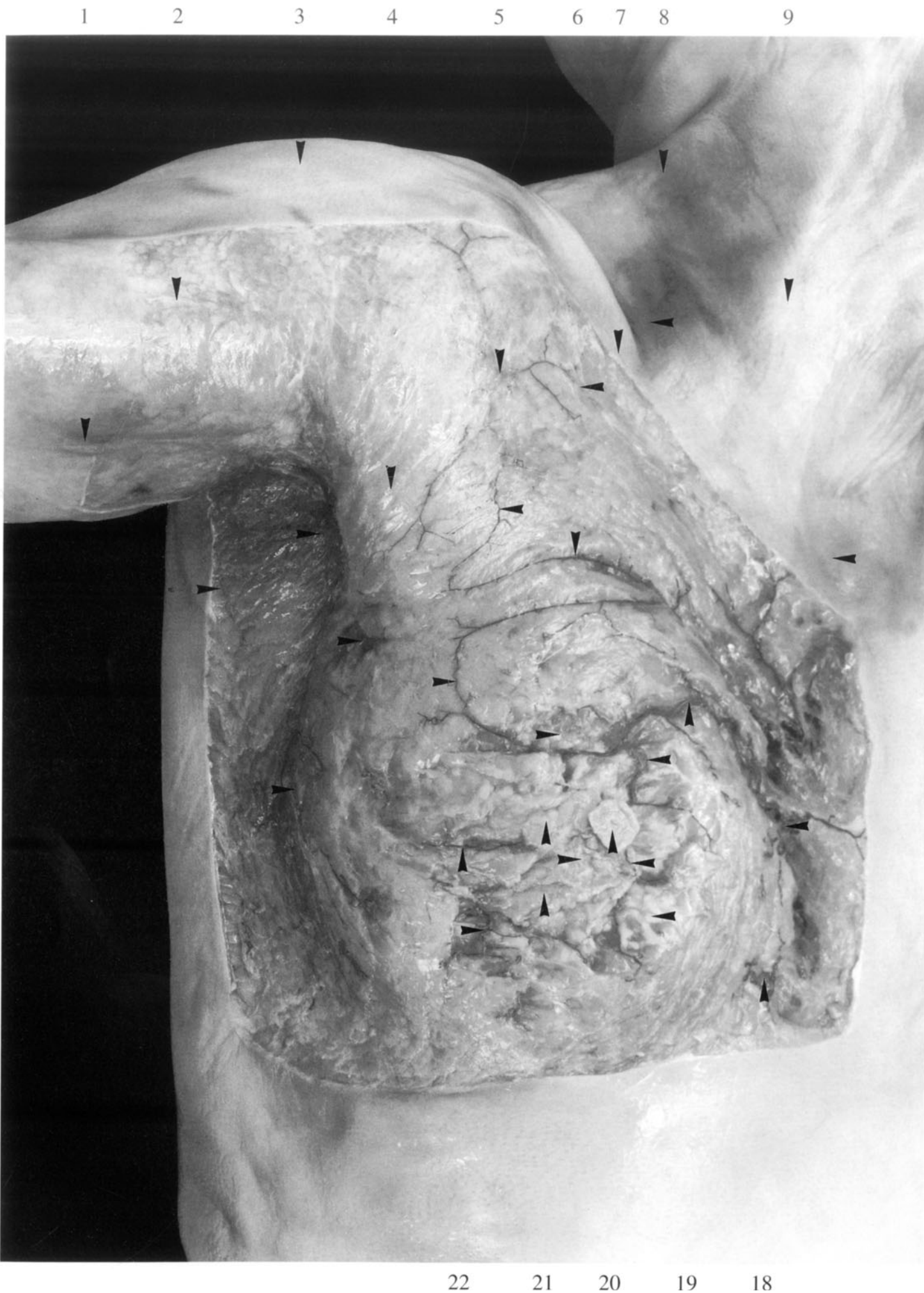


Figure 89

**Female Breast 4
Fixation of the Breast**

- | | | | |
|----|---|----|--|
| 1 | Lateral bicipital sulcus | 14 | Inferior suspensory ligament of breast |
| 2 | Medial bicipital sulcus | 15 | Pectoralis major muscle
(covered by superficial pectoral fascia) |
| 3 | Deltoid muscle | 16 | Pectoralis major muscle
(lateral border,
covered by superficial pectoral fascia) |
| 4 | Trapezius muscle | 17 | Deep layer of stratum subcutaneum (cut edge) |
| 5 | Medial mammary branch
of second perforating branch | 18 | Lateral suspensory ligament of breast (cut edge) |
| 6 | Anastomosis between medial mammary branch
and lateral mammary branch | 19 | Subcutaneous tissue |
| 7 | Nipple | 20 | Superficial thoracic artery (of MANCHOT) |
| 8 | Fourth intercostal artery
(lateral mammary branch) | 21 | Deep layer of stratum subcutaneum
(inner surface) |
| 9 | Breast (fat between skin and breast tissue) | 22 | Lateral suspensory ligament of breast (cut edge) |
| 10 | Deep layer of stratum subcutaneum
(inner surface) | 23 | Posterior axillary fold |
| 11 | Subcutaneous tissue | 24 | Anterior axillary fold |
| 12 | Pectoralis major muscle | 25 | Axillary fossa |
| 13 | Breast (parenchyma) | | |

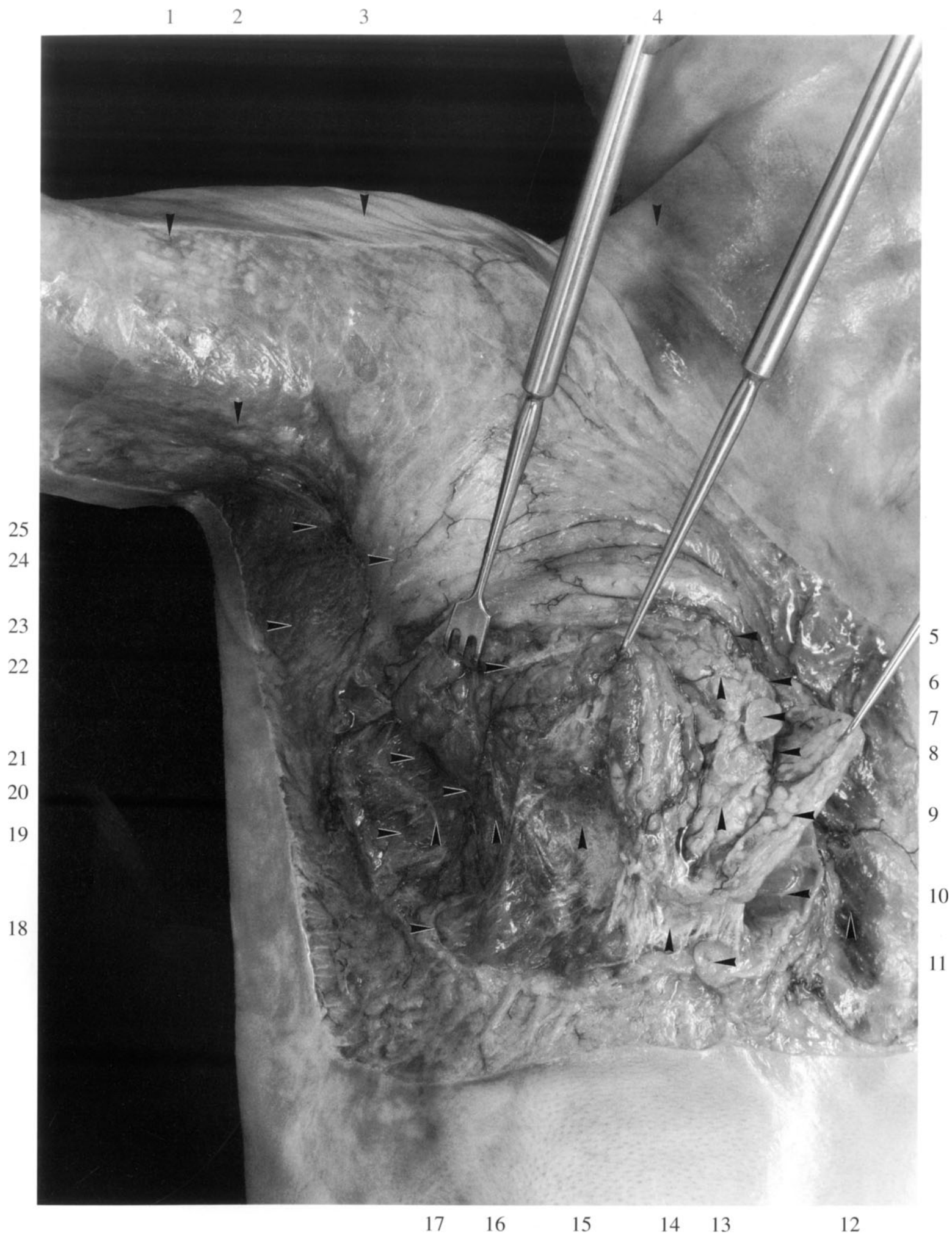


Figure 90 **Female Breast 5**
Bed and Anchoring Structures 1

- | | | | |
|----|---|----|--|
| 1 | Axillary fossa | 12 | Subcutaneous tissue |
| 2 | Anterior axillary fold | 13 | Pectoralis major muscle |
| 3 | Subcutaneous tissue of anterior axillary fold | | (covered by superficial pectoral fascia) |
| 4 | Pectoralis major muscle | 14 | Lateral suspensory ligament of breast (cut edge) |
| | (covered by superficial pectoral fascia) | 15 | Superficial axillary fascia |
| 5 | Breast (posterior surface) | 16 | Lateral suspensory ligament of breast |
| 6 | Breast (fatty tissue layer on posterior surface) | 17 | Subcutaneous tissue |
| 7 | Sternoclavicular joint | 18 | Deep layer of stratum subcutaneum (cut edge) |
| 8 | Internal thoracic artery | 19 | Lateral thoracic artery (mammary branch) |
| | (first perforating branch) | 20 | Superficial thoracic artery (of MANCHOT) |
| 9 | Inferior suspensory ligament of breast (cut edge) | 21 | Lateral thoracic artery (mammary branch) |
| 10 | Internal thoracic artery | 22 | Deep layer of stratum subcutaneum (cut edge) |
| | (third perforating branch) | 23 | Superficial thoracic artery (of MANCHOT) |
| 11 | Pectoralis major muscle | | (mammary branch) |
| | (covered by superficial pectoral fascia) | | |

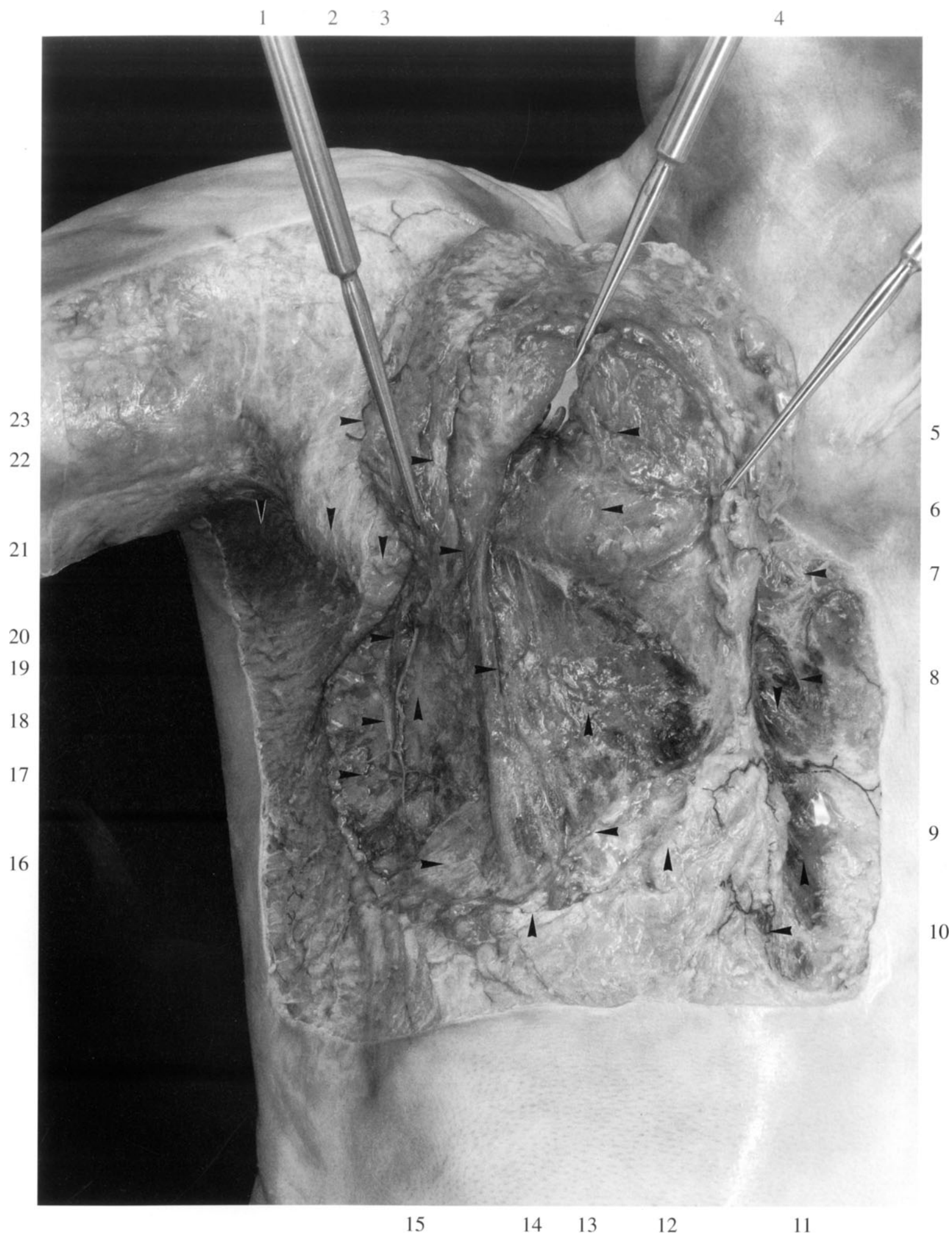


Figure 91 **Female Breast 6**
Bed and Anchoring Structures 2

- | | |
|--|---|
| 1 Superior suspensory ligament of breast | 13 Subcutaneous tissue (cut surface) |
| 2 Clavicle | 14 Internal thoracic artery
(third perforating branch) |
| 3 Supraclavicular fossa | 15 Medial suspensory ligament of breast (cut edge) |
| 4 Sternocleidomastoid muscle | 16 Inferior suspensory ligament of breast (cut edge) |
| 5 Trapezius muscle | 17 Lateral suspensory ligament of breast (cut edge) |
| 6 Infraclavicular fossa | 18 Pectoralis major muscle (lateral border) |
| 7 Subcutaneous tissue (cut surface) | 19 Subcutaneous tissue (cut surface) |
| 8 Deep layer of stratum subcutaneum | 20 Breast (posterior surface) |
| 9 Pectoralis major muscle
(covered by superficial pectoral fascia) | 21 Lateral suspensory ligament of breast |
| 10 Internal thoracic artery
(first perforating branch) | 22 Deep layer of stratum subcutaneum (cut edge) |
| 11 Internal thoracic artery
(second perforating branch) | 23 Superficial thoracic artery (of MANCHOT) |
| 12 Pectoralis major muscle
(covered by superficial pectoral fascia) | 24 Lateral suspensory ligament of breast |
| | 25 Breast
(projecting terminal buds of lactiferous ducts,
enveloped by connective tissue) |

1 2 3 4

25
24
23
22
21

5
6
7
8
9
10
11
12
13

20 19 18 17 16 15 14



Figure 92 **Female Breast 7**
Cut Surface of Mastectomy Specimen

- | | | | |
|---|---|----|---|
| 1 | Anastomosis between thoracoacromial artery and first perforating branch | 10 | Lactiferous sinus (longitudinal section) |
| 2 | Subcutaneous tissue (cut surface) | 11 | Breast stroma (cut surface) |
| 3 | Breast stroma in axillary tail (cut surface) | 12 | Breast stroma (cut surface) |
| 4 | Breast stroma (cut surface) | 13 | Breast stroma (cut surface) |
| 5 | Subcutaneous tissue (surface) | 14 | Lactiferous sinus (longitudinal section) |
| 6 | Intramammary fat | 15 | Artery supplying nipple and areola |
| 7 | Medial mammary branch of second perforating branch | 16 | Breast stroma (cut surface) |
| 8 | Areola (cut edge) | 17 | Cord of breast stroma (cut surface) |
| 9 | Excretory portions of lactiferous ducts | 18 | Anastomosis between first and second perforating branches |



Figure 93 **Female Breast 8**
Attachment of the Skin
Venous Drainage

- | | | | |
|---|---|----|--|
| 1 | Sternoclavicular joint | 10 | Vein of superficial venous network |
| 2 | Clavicle | 11 | Nipple |
| 3 | Infraclavicular fossa | 12 | Mammary vein (deep drainage) |
| 4 | Deltoideopectoral sulcus | 13 | Areola |
| 5 | Axillary fossa | 14 | Retinaculum cutis (transversely oriented) |
| 6 | Anterior axillary fold | 15 | Subcutaneous tissue |
| 7 | Posterior axillary fold | 16 | Retinacula cutis (longitudinally oriented) |
| 8 | Retinaculum cutis (transversely oriented) | 17 | Retinacula cutis (longitudinally oriented) |
| 9 | Vein draining the superficial venous network and circulus venosus (of HALLER) | | |

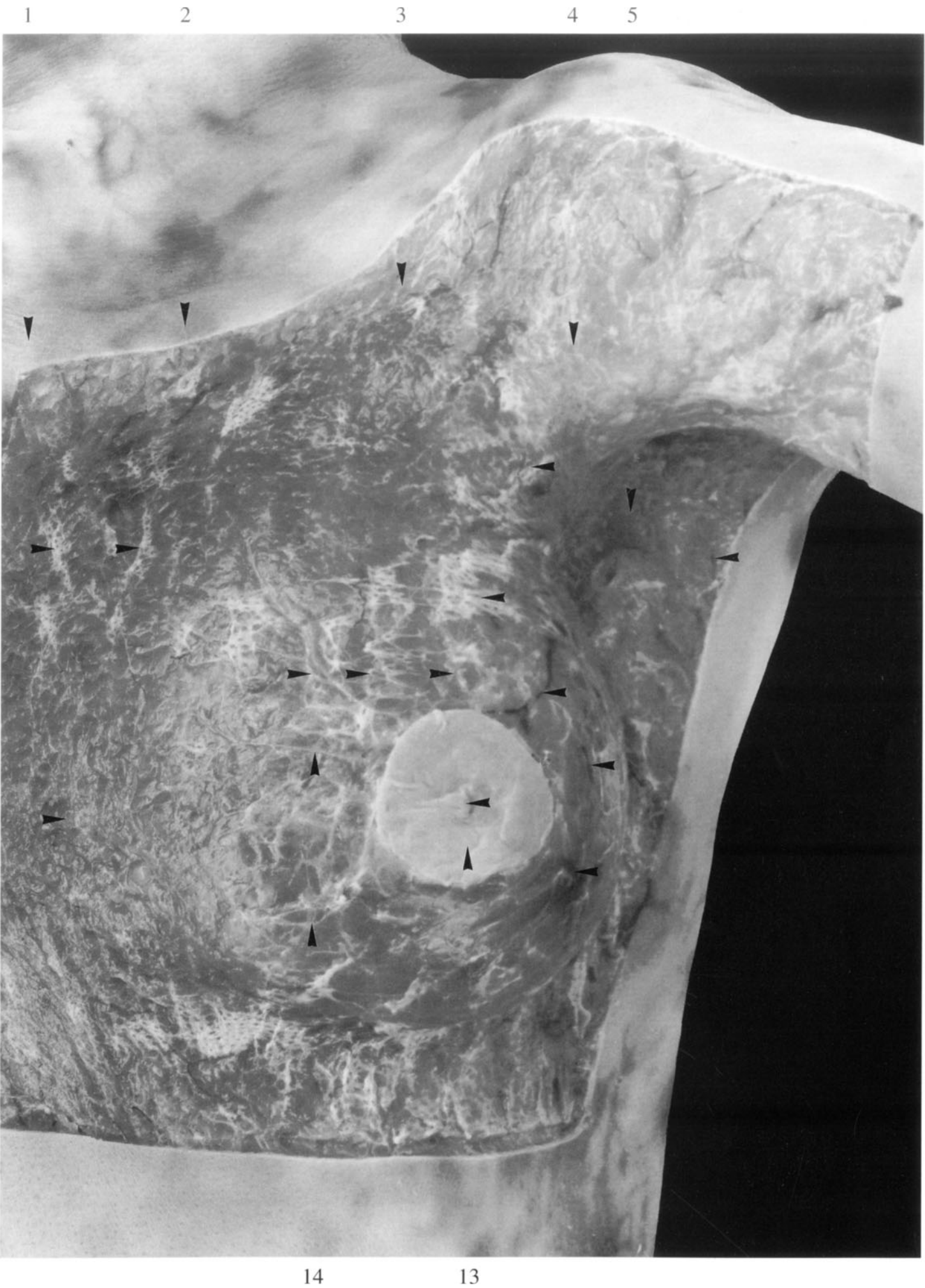


Figure 94

**Female Breast 9
Vascular Supply**

- | | | | |
|----|--|----|--|
| 1 | Internal thoracic vein
(second perforating branch) | 14 | Areola |
| 2 | Internal thoracic artery
(first perforating branch) | 15 | Circulus arteriosus of breast |
| 3 | Internal thoracic vein (first perforating branch) | 16 | Posterior intercostal artery
(lateral mammary branch) |
| 4 | Subcutaneous tissue (cut edge) | 17 | Breast (cut edge of fatty tissue) |
| 5 | Medial mammary branch
of first perforating branch | 18 | Medial mammary branch
of second perforating branch |
| 6 | Subcutaneous tissue (cut edge) | 19 | Subcutaneous tissue (cut edge) |
| 7 | Anterior axillary fold | 20 | Internal thoracic vein
(third perforating branch) |
| 8 | Posterior axillary fold | 21 | Internal thoracic artery
(fourth perforating branch) |
| 9 | Infraclavicular fossa | 22 | Internal thoracic artery
(third perforating branch) |
| 10 | Axillary fossa | 23 | Internal thoracic artery
(second perforating branch) |
| 11 | Breast (cut edge of fatty tissue) | 24 | Sternoclavicular joint |
| 12 | Nipple | | |
| 13 | Breast (cut edge of fatty tissue) | | |

1 2 3 4 5 6 7 8

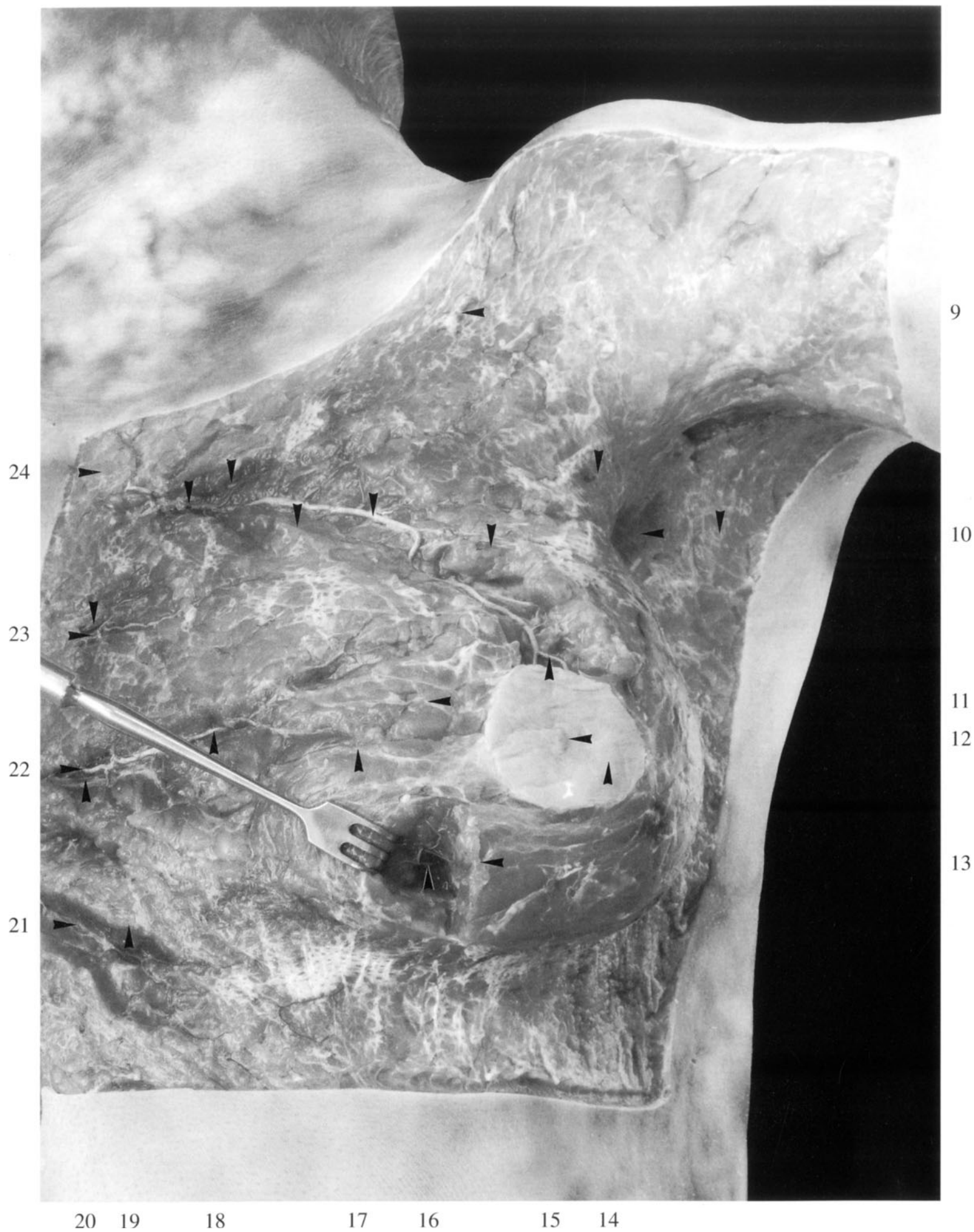


Figure 95 **Female Breast 10**
Vascular Supply

- | | | | |
|----|---|----|---|
| 1 | Internal thoracic artery
(second perforating branch) | 13 | Lateral thoracic artery
(inferior mammary branch) |
| 2 | Internal thoracic artery
(first perforating branch) | 14 | Breast (cut edge of fatty tissue) |
| 3 | Medial mammary branch
of first perforating branch | 15 | Breast (cut edge of fatty tissue) |
| 4 | Medial mammary vein | 16 | Subcutaneous tissue (cut edge) |
| 5 | Drainage of superficial vascular network
of breast | 17 | Serratus anterior muscle |
| 6 | Lateral thoracic vein | 18 | Subcutaneous tissue (cut edge) |
| 7 | Anterior axillary fold | 19 | Breast (cut edge of fatty tissue) |
| 8 | Posterior axillary fold | 20 | Posterior intercostal vein
(lateral mammary branch) |
| 9 | Infraclavicular fossa | 21 | Nipple |
| 10 | Axillary fossa | 22 | Internal thoracic artery and vein
(third perforating branches) |
| 11 | Breast (cut edge of fatty tissue) | 23 | Breast (body of mammary gland) |
| 12 | Lateral thoracic artery
(superior mammary branch) | 24 | Areola |
| | | 25 | Internal thoracic vein
(second perforating branch) |
| | | 26 | Breast (cut edge of fatty tissue) |

1 2 3 4 5 6 7 8

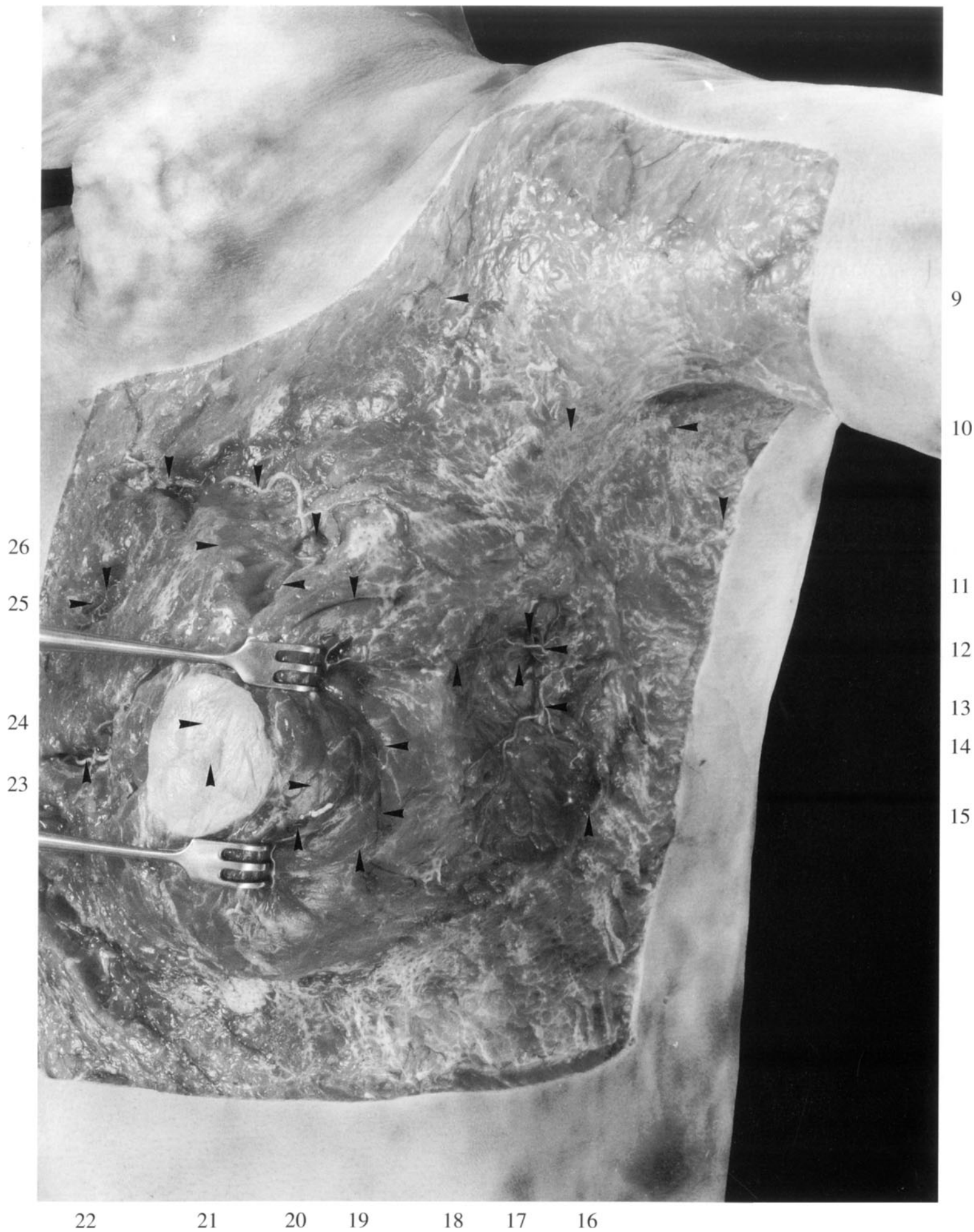


Figure 96**Thoracic Cavity 1
Pleural Recess**

- | | | | |
|----|---|----|--|
| 1 | Right lung (upper lobe) | 20 | Phrenicmediastinal recess |
| 2 | Internal thoracic artery | 21 | Costodiaphragmatic recess |
| 3 | Jugular notch | 22 | Diaphragm |
| 4 | Thymic artery | 23 | Rectus abdominis muscle |
| 5 | Left lung (upper lobe) | 24 | Xiphoid process |
| 6 | Sternocleidomastoid muscle
(tendon of sternal head) | 25 | Rectus abdominis muscle |
| 7 | Internal thoracic artery | 26 | Pleural fat lobules in phrenicmediastinal recess |
| 8 | Aortic arch | 27 | Musculophrenic artery (resected) |
| 9 | Costal pleura (cut edge) | 28 | Right lung (lower lobe) |
| 10 | Thymic residue in retrosternal fat pad | 29 | Border of costomediastinal recess |
| 11 | Left lung (anterior border) | 30 | Middle lobe of right lung |
| 12 | Border of costomediastinal recess | 31 | Right lung (anterior border) |
| 13 | Mediastinal pleura | 32 | Right lung (horizontal fissure) |
| 14 | Border of costomediastinal recess | 33 | Ascending aorta covered by pericardium |
| 15 | Pericardium (fibrous) | 34 | Costal pleura (cut edge) |
| 16 | Left lung (oblique fissure) | 35 | Thymic vein |
| 17 | Lingula of left lung | 36 | Thymic artery |
| 18 | Junction of costomediastinal recess
with costodiaphragmatic recess | 37 | Left brachiocephalic vein |
| 19 | Left lung (lower lobe) | 38 | Manubrium sterni (cut surface) |
| | | 39 | Sternocleidomastoid muscle
(tendon of sternal head) |



Figure 97

**Right Lung
Structure and Attachments**

- | | |
|---|--|
| 1 Middle lobe | 15 Phrenicomedial recess |
| 2 Horizontal fissure | 16 Diaphragm (cut surface) |
| 3 Upper lobe | 17 Parietal peritoneum |
| 4 Superior vena cava covered
by mediastinal pleura | 18 Mediastinal pleura (cut edge) |
| 5 Azygos vein covered by mediastinal pleura | 19 Phrenicomedial recess |
| 6 Root of lung | 20 Right lung (inferior border) |
| 7 Right lung (anterior border) | 21 Oblique fissure |
| 8 Subpleural fat layer | 22 Middle lobe (interlobar surface) |
| 9 Acinus (of middle lobe) | 23 Right lung (inferior border) |
| 10 Lower lobe (mediastinal surface) | 24 Right lung (inferior border) |
| 11 Pericardium covered by mediastinal pleura | 25 Diaphragm covered by diaphragmatic pleura |
| 12 Subpleural fat layer (cut surface) | 26 Lower lobe (diaphragmatic surface) |
| 13 Mediastinal pleura (cut surface) | 27 Lower lobe (interlobar surface) |
| 14 Right phrenicopulmonary ligament
(of TEUTLEBEN)
[right phrenicopericardial ligament
(of TANDLER)] | 28 Middle lobe (diaphragmatic surface) |
| | 29 Interlobular septa |



Figure 98

**Thoracic Cavity 2
Root of the Lung**

- | | | | |
|----|---|----|---|
| 1 | Upper lobe (mediastinal surface) | 18 | Pleural fat lobule |
| 2 | Azygos vein covered by mediastinal pleura | | from phrenicomedastinal recess |
| 3 | Superior vena cava | 19 | Costodiaphragmatic recess |
| | covered by mediastinal pleura | 20 | Rectus abdominis muscle (cut edge) |
| 4 | Superior interpleural area | 21 | Costal pleura (cut edge) |
| 5 | Thymic artery | 22 | Costodiaphragmatic recess |
| 6 | Left lung (upper lobe) | 23 | Diaphragm (cut surface of rib attachment) |
| 7 | Sternocleidomastoid muscle | 24 | Intercostal muscles (cut surface) |
| 8 | Internal thoracic artery | 25 | External oblique muscle (cut surface) |
| 9 | Costal pleura (cut edge) | 26 | Pleural fat lobule in costodiaphragmatic recess |
| 10 | Phrenic nerve covered by mediastinal pleura | 27 | Diaphragm covered by diaphragmatic pleura |
| 11 | Pericardiophrenic artery covered | 28 | Oblique fissure (fused by fibrosis) |
| | by mediastinal pleura | 29 | Lower lobe |
| 12 | Costal pleura (cut edge) | 30 | Middle lobe |
| 13 | Costomediastinal recess | 31 | Pulmonary hilum |
| 14 | Superior right pulmonary vein in lung root | 32 | Right lung (anterior border) |
| 15 | Mediastinal pleura | 33 | Manubrium sterni (cut surface) |
| 16 | Costomediastinal recess | 34 | Sternocleidomastoid muscle |
| 17 | Costal pleura (cut edge) | | |



Figure 99**Thoracic Cavity 3
Root of the Lung 2
Pulmonary Veins**

- | | | | |
|----|---------------------------------------|----|--|
| 1 | Pectoralis major muscle (cut surface) | 22 | Pleural fat lobule in phrenicomedial recess |
| 2 | Pectoralis minor muscle (cut surface) | 23 | Phrenicomedial recess |
| 3 | Second rib (cut surface) | 24 | Fat lobule in costodiaphragmatic recess |
| 4 | Pulmonary hilum | 25 | Costal pleura (cut edge) |
| 5 | Superior tracheobronchial lymph node | 26 | Costodiaphragmatic recess |
| 6 | Internal thoracic artery | 27 | Costal arch (cut surface) |
| 7 | Superior vena cava | 28 | Diaphragm (cut surface of rib attachment) |
| 8 | Superior interpleural area | 29 | External oblique muscle |
| 9 | Costal pleura (cut edge) | 30 | Diaphragm covered by diaphragmatic pleura |
| 10 | Right lung (upper lobe) | 31 | Lower lobe |
| 11 | Internal thoracic artery | 32 | Middle lobe of right lung |
| 12 | Pericardiophrenic artery | 33 | Superior right pulmonary vein
(middle lobar branch) |
| 13 | Phrenic nerve | 34 | Superior right pulmonary vein
(posterior branch) |
| 14 | Anterior mediastinal lymph node | 35 | Superior right pulmonary vein (anterior branch) |
| 15 | Right pulmonary artery | 36 | Superior right pulmonary vein (apical branch) |
| 16 | Inferior tracheobronchial lymph node | 37 | Azygos vein |
| 17 | Mediastinal pleura (cut edge) | 38 | Superior tracheobronchial lymph nodes |
| 18 | Costomediastinal recess | 39 | Manubrium sterni (cut surface) |
| 19 | Inferior right pulmonary vein | | |
| 20 | Costal pleura (cut edge) | | |
| 21 | Rectus abdominis muscle (cut surface) | | |

1 2 3 4 5 6 7 8 9 10



Figure 100**Thoracic Cavity 4
Root of the Lung 3
Pulmonary Arteries and Bronchi
Lymph Nodes**

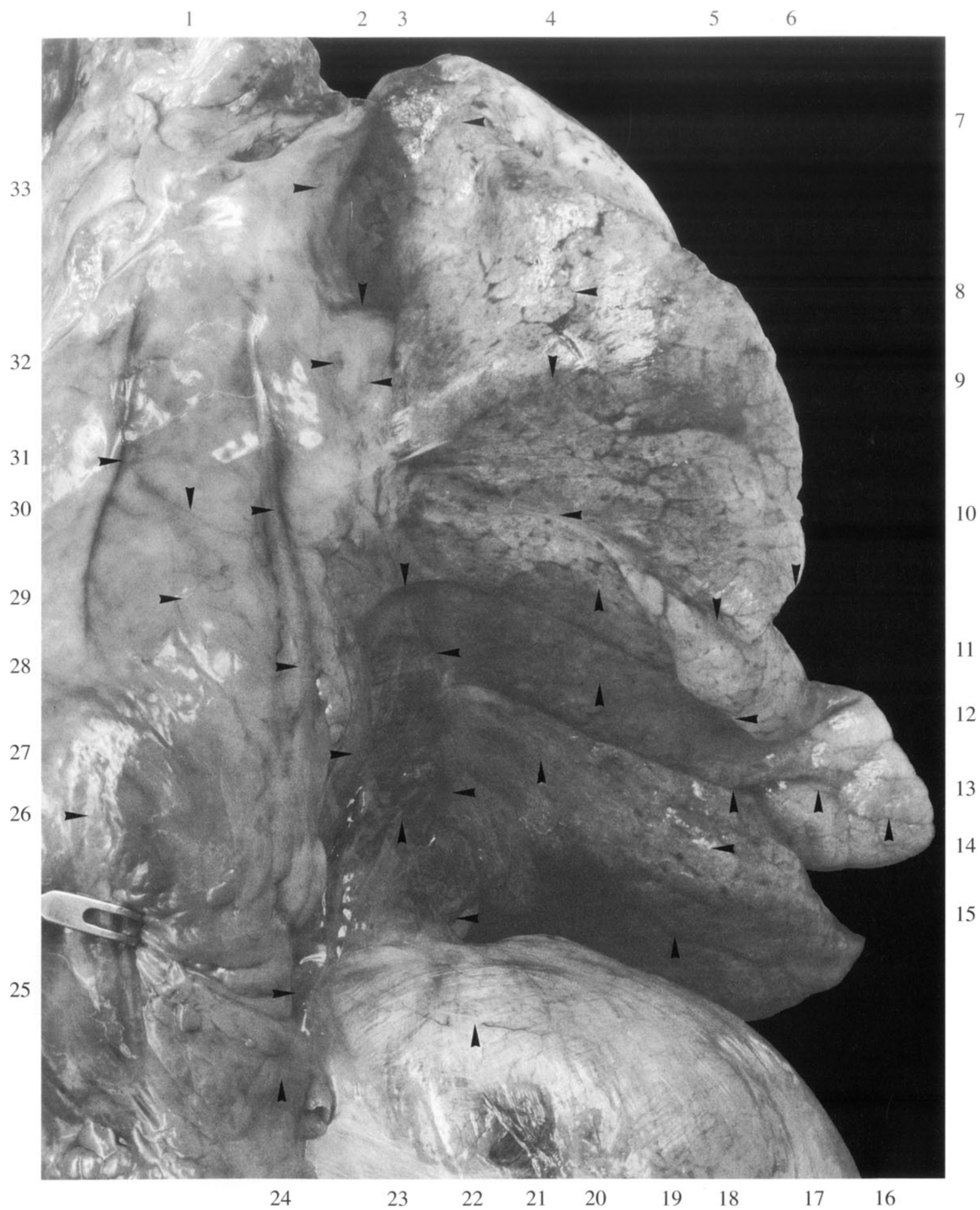
- | | | | |
|----|---|----|--|
| 1 | Pectoralis major muscle (cut surface) | 21 | Mediastinal pleura (cut edge) |
| 2 | Pectoralis minor muscle (cut surface) | 22 | Pericardium |
| 3 | Right lung (upper lobe) | 23 | Phrenicomedial recess |
| 4 | Superior right pulmonary artery (apical branch) | 24 | Pleural fat lobule in phrenicomedial recess |
| 5 | Right pulmonary artery (anterior trunk) | 25 | Costal pleura (cut edge) |
| 6 | Right main bronchus | 26 | Costodiaphragmatic recess |
| 7 | Superior tracheobronchial lymph nodes | 27 | Diaphragm covered by diaphragmatic pleura |
| 8 | Superior vena cava | 28 | Oblique fissure (fused by fibrosis) |
| 9 | Anterior mediastinal lymph node | 29 | Middle lobe of right lung |
| 10 | Costomediastinal recess | 30 | Superior right pulmonary vein
(middle lobar branch) |
| 11 | Costal pleura (cut edge) | 31 | Superior right pulmonary vein
(posterior branch) |
| 12 | Manubrium sterni (cut surface) | 32 | Superior right pulmonary vein (anterior branch) |
| 13 | Phrenic nerve and pericardiophrenic artery | 33 | Bronchopulmonary lymph nodes |
| 14 | Azygos vein | 34 | Superior tracheobronchial lymph nodes |
| 15 | Superior tracheobronchial lymph node | 35 | Node of azygos venous arch |
| 16 | Right pulmonary artery | 36 | Paratracheal lymph nodes |
| 17 | Inferior tracheobronchial lymph nodes | 37 | Internal thoracic artery |
| 18 | Mediastinal pleura (cut edge) | | |
| 19 | Lateral pericardial lymph nodes | | |
| 20 | Lateral pericardial node | | |

1 2 3 4 5 6 7 8 9 10 11



Figure 101**Left Lung
Structure and Attachments**

- | | | | |
|----|---|----|---|
| 1 | Anastomosis between thymic artery and pericardiophrenic artery | 17 | Lingula of left lung (mediastinal surface) |
| 2 | Root of lung (upper border) | 18 | Oblique fissure |
| 3 | Root of lung (lower border) | 19 | Lower lobe (diaphragmatic surface) |
| 4 | Upper lobe | 20 | Upper and lower lingular segments |
| 5 | Anterior marginal incisure at upper end of cardiac notch | 21 | Lower lobe (mediastinal surface) |
| 6 | Left lung (anterior border) | 22 | Diaphragm covered by diaphragmatic pleura |
| 7 | Apex of lung | 23 | Pulmonary ligament |
| 8 | Interlobular septa | 24 | Pleural fat lobules in phrenicomedastinal recess |
| 9 | Root of lung | 25 | Phrenicomedastinal recess |
| 10 | Intersegmental septum between anterior segment (of upper lobe) and upper lingular segment | 26 | Pericardium covered by mediastinal pleura |
| 11 | Pulmonary ligament (attachment to upper lobe) | 27 | Cardiac left ventricle covered by pericardium and mediastinal pleura |
| 12 | Left lung (anterior border) | 28 | Phrenic nerve covered by mediastinal pleura |
| 13 | Pulmonary ligament (attachment to lower lobe) | 29 | Mediastinal pleura |
| 14 | Lower lobe (interlobar surface) | 30 | Phrenic nerve and pericardiophrenic vessels covered by mediastinal pleura |
| 15 | Pulmonary ligament (free border) | 31 | Thymic vessels covered by mediastinal pleura |
| 16 | Lingula of left lung (diaphragmatic surface) | 32 | Tracheobronchial lymph node covered by pleura |
| | | 33 | Mediastinal pleura at junction with pleural dome (cut edge) |



- | | |
|--|---|
| 1 Middle lobe of right lung (interlobar surface) | 23 Costodiaphragmatic recess |
| 2 Upper lobe | with folds of pleural fat |
| 3 Sternum (jugular notch) | 24 Phrenicomedial recess |
| 4 Sternoclavicular joint | with folds of pleural fat |
| 5 Left brachiocephalic vein | 25 Junction of phrenicomedial recess, |
| 6 Internal thoracic artery (cut surface) | costomediastinal recess, |
| 7 Mediastinal pleura | and costodiaphragmatic recess, |
| 8 Left lung (S I of apicoposterior segment) | with folds of pleural fat |
| 9 Left lung (S II of apicoposterior segment) | 26 Fold of pleural fat in costomediastinal recess |
| 10 Left lung (anterior segment) | 27 Tendinous origin |
| 11 Pericardiophrenic artery | of transversus abdominis muscle |
| covered by mediastinal pleura | and diaphragm on inner surface |
| 12 Thymic artery | of seventh costal cartilage |
| 13 Phrenic nerve covered by mediastinal pleura | 28 Middle lobe of right lung |
| 14 Costomediastinal recess | 29 Xiphoid process with attached ligaments |
| 15 Tracheobronchial lymph node | 30 Pericardium |
| (lateral group, covered by mediastinal pleura) | 31 Costomediastinal recess |
| 16 Pericardiophrenic vein | 32 Costomediastinal recess |
| covered by mediastinal pleura | 33 Horizontal fissure of right lung |
| 17 Root of lung (fibrotic) | 34 Thymus (remnant) |
| 18 Left lung (lingular segments) | 35 Mediastinal pleura |
| 19 Oblique fissure | 36 Thymic vein and thymus (remnant) |
| 20 Left lung (lower lobe) | 37 Aortic arch |
| 21 Pericardiophrenic artery | 38 Thymic artery |
| 22 Diaphragm covered by diaphragmatic pleura | 39 Pericardiophrenic artery |
| | 40 Manubrium sterni (cut surface) |



Figure 103**Thoracic Cavity 5
Root of the Lung 5
Pulmonary Veins
Superior Mediastinum**

- | | |
|---|--|
| 1 Internal thoracic artery | 25 Diaphragmatic pleura |
| 2 Manubrium sterni (cut surface) | in costodiaphragmatic recess |
| 3 Costomediastinal recess | 26 Fold of pleural fat in phrenicomediastinal recess |
| 4 Left brachiocephalic vein | (cut edge) |
| 5 Internal thoracic artery | 27 Costal pleura in costodiaphragmatic recess |
| 6 Mediastinal pleura (cut edge) | 28 Tendinous origin |
| 7 Accessory hemiazygos vein | of transversus abdominis muscle and diaphragm |
| 8 Left pulmonary artery | on inner surface of seventh costal cartilage |
| 9 Left lung (apicoposterior segment) | 29 Musculophrenic artery |
| 10 Left lung (anterior segment) | 30 Transversus abdominis muscle |
| 11 Vagus nerve | 31 Xiphisternal synchondrosis |
| 12 Mediastinal vein | 32 Fold of pleural fat in costomediastinal recess |
| 13 Phrenic nerve | 33 Pericardium |
| 14 Tracheobronchial lymph nodes (lateral group) | 34 Costomediastinal recess |
| 15 Superior left pulmonary vein | 35 Left atrial appendage (covered by pericardium) |
| (apicoposterior branch) | 36 Pulmonary trunk (covered by pericardium) |
| 16 Superior left pulmonary vein (anterior branch) | 37 Pericardiophrenic vein |
| 17 Superior left pulmonary vein (lingular branch) | 38 Thymic vein |
| 18 Mediastinal pleura | 39 Aortic arch |
| 19 Oblique fissure | (covered by subpleural connective tissue) |
| 20 Left lung (lower lobe) | 40 Thymic artery |
| 21 Phrenic nerve | 41 Pericardiophrenic artery |
| 22 Diaphragm covered by diaphragmatic pleura | 42 Sternocleidomastoid muscle |
| 23 Fold of pleural fat in costodiaphragmatic recess | (tendon of sternal head) |
| 24 Left lung (upper and lower lingular segments) | |



Figure 104

**Thoracic Cavity 6
Root of the Lung 6
Pulmonary Veins
Lymph Nodes**

- | | | | |
|----|--|----|--|
| 1 | Right lung | 15 | Inferior left pulmonary vein |
| 2 | Internal thoracic artery | 16 | Phrenic nerve covered by mediastinal pleura |
| 3 | Superior interpleural area
with retrosternal fat pad | 17 | Oblique fissure (fused by fibrosis) |
| 4 | Ascending aorta with pericardium | 18 | Left lung (lower lobe) |
| 5 | Internal thoracic artery | 19 | Phrenicomedial recess |
| 6 | Left lung
(upper lobe with fibrotic pulmonary pleura) | 20 | Costodiaphragmatic recess |
| 7 | Sternocleidomastoid muscle
(tendon of sternal head) | 21 | Fold of pleural fat in phrenicomedial recess |
| 8 | Pectoralis major muscle (cut surface) | 22 | Costal pleura (cut edge) |
| 9 | Mediastinal vein | 23 | Costomediastinal recess |
| 10 | Superior tracheobronchial lymph nodes
(lateral group) | 24 | Costomediastinal recess |
| 11 | Left pulmonary artery | 25 | Fold of pleural fat in costomediastinal recess |
| 12 | Superior left pulmonary vein
(apicoposterior branch) | 26 | Pericardiophrenic artery (pericardial branch) |
| 13 | Pulmonary hilum | 27 | Costomediastinal recess |
| 14 | Superior left pulmonary vein
(lingular branch with anterior branch) | 28 | Costal pleura (cut edge) |
| | | 29 | Ascending aorta covered by pericardium |
| | | 30 | Mediastinal pleura (cut edge) |
| | | 31 | Phrenic nerve with pericardiophrenic vessels |
| | | 32 | Costal pleura (cut edge) |
| | | 33 | Manubrium sterni (cut surface) |

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

33

32

31

30

29

28

27

26

25

24

23

22

21

20



Figure 105

**Thoracic Cavity 7
Root of the Lung 7
Pulmonary Artery**

- | | | | |
|----|---|----|--|
| 1 | Right lung | 17 | Pericardiophrenic artery |
| 2 | Internal thoracic artery | 18 | Phrenic nerve |
| 3 | Superior interpleural area
with retrosternal fat pad | 19 | Costodiaphragmatic recess |
| 4 | Dome of pericardium | 20 | Diaphragm covered by diaphragmatic pleura |
| 5 | Mediastinal pleura (cut edge) | 21 | Pulmonary ligament |
| 6 | Accessory hemiazygos vein | 22 | Phrenicomedastinal recess |
| 7 | Superior left pulmonary vein (anterior branch) | 23 | Fold of pleural fat in phrenicomedastinal recess |
| 8 | Left lung
(upper lobe with fibrotic parietal pleura) | 24 | Musculophrenic artery |
| 9 | Sternocleidomastoid muscle
(tendon of sternal head) | 25 | Costal pleura (cut edge) |
| 10 | Internal thoracic artery | 26 | Costomediastinal recess |
| 11 | Vagus nerve | 27 | Pericardium covered by mediastinal pleura |
| 12 | Bronchial artery | 28 | Costal pleura (cut edge) |
| 13 | Left pulmonary artery | 29 | Costomediastinal recess |
| 14 | Superior left pulmonary vein
(apicoposterior branch) | 30 | Left main bronchus |
| 15 | Superior left pulmonary vein (lingular branch) | 31 | Pericardium (over pulmonary trunk) |
| 16 | Superior left pulmonary vein | 32 | Phrenic nerve with pericardiophrenic artery |
| | | 33 | Aortic arch |
| | | 34 | Costal pleura (cut edge) |
| | | 35 | Manubrium sterni (cut surface) |

1 2 3 4 5 6 7 8



Figure 106**Thoracic Cavity 8
Root of the Lung 8
Right Main Bronchus**

- | | | | |
|----|--|----|--|
| 1 | Pectoralis minor muscle (cut surface) | 17 | Phrenicomedial recess |
| 2 | Pectoralis major muscle (cut surface) | 18 | Fold of pleural fat |
| 3 | Right lung | | from phrenicomedial recess |
| 4 | Internal thoracic artery | 19 | Diaphragm covered by diaphragmatic pleura |
| 5 | Superior interpleural area
with retrosternal fat pad | 20 | Costodiaphragmatic recess |
| 6 | Thymus (remnant) | 21 | Superior left pulmonary vein |
| 7 | Bronchial artery | 22 | Costomediastinal recess |
| 8 | Pulmonary hilum | 23 | Costal pleura (cut edge) |
| 9 | Internal thoracic artery | 24 | Pericardium with mediastinal pleura |
| 10 | Phrenic nerve | 25 | Fold of pleural fat from costomediastinal recess |
| 11 | Vagus nerve | 26 | Retrosternal fat pad |
| 12 | Left pulmonary artery | | covered by mediastinal pleura |
| 13 | Superior left pulmonary vein
(apicoposterior branch) | 27 | Costomediastinal recess |
| 14 | Superior left pulmonary vein
(lingular branch with anterior branch) | 28 | Left main bronchus with bronchial artery |
| 15 | Inferior left pulmonary vein | 29 | Aortic arch |
| 16 | Phrenic nerve and pericardiophrenic artery | 30 | Costal pleura (cut edge) |
| | | 31 | Manubrium sterni (cut surface) |
| | | 32 | Sternocleidomastoid muscle
(tendon of sternal head) |

1 2 3 4 5 6 7 8

32

31

30

29

28

27

26

25

24

23

9

10

11

12

13

14

15

16

17

18

22

21

20

19

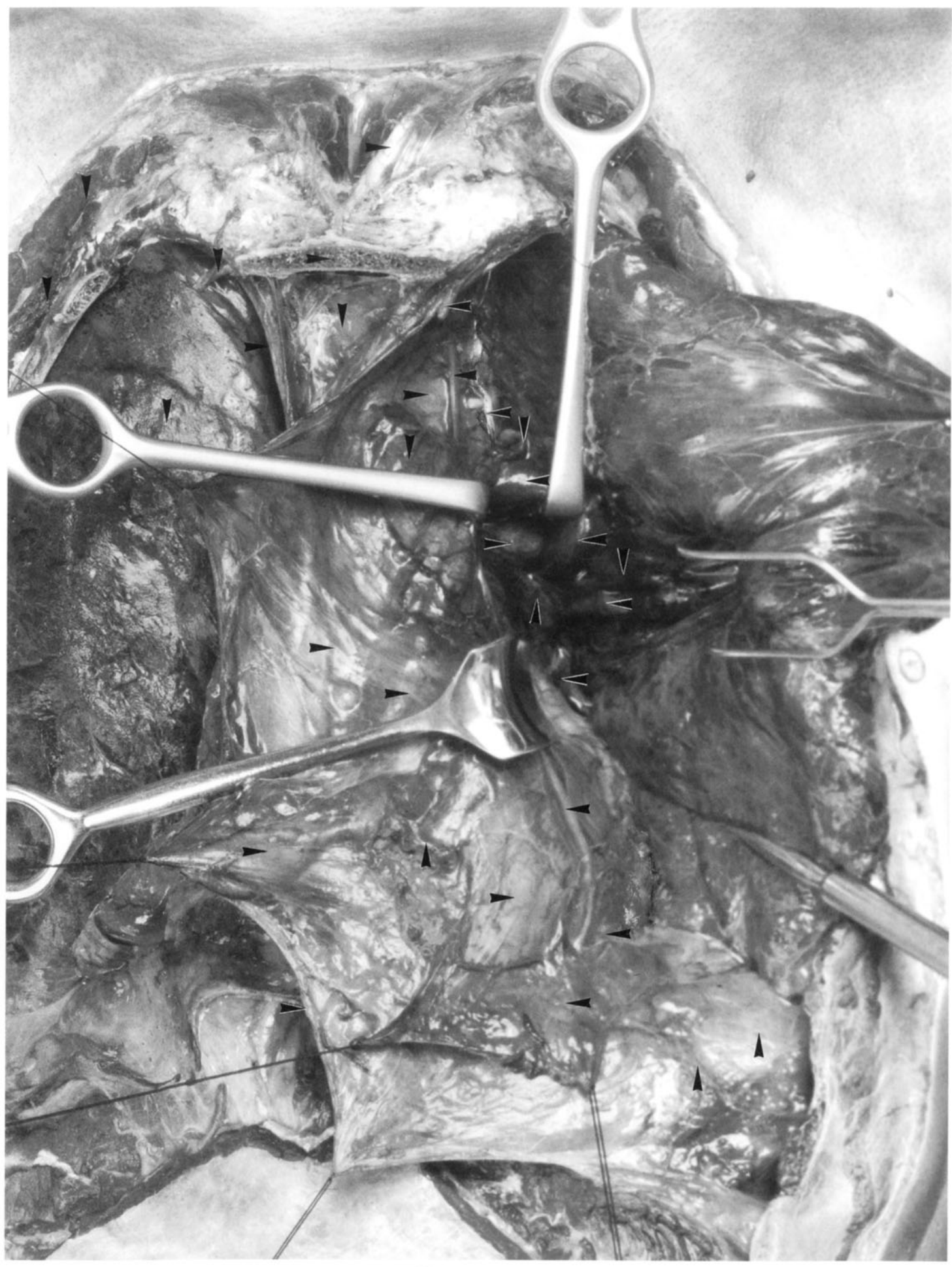


Figure 107**Pulmonary Arteries
Relations and Branches**

- | | | | |
|----|--|----|--|
| 1 | Posterior segmental bronchus | 21 | Anterior basal segmental bronchus |
| 2 | Right pulmonary artery
(posterior descending branch) | 22 | Left pulmonary artery (superior lingular branch) |
| 3 | Right pulmonary artery (anterior trunk) | 23 | Left pulmonary artery (inferior lingular branch) |
| 4 | Right main bronchus | 24 | Left pulmonary artery (anterior basal branch) |
| 5 | Right pulmonary artery | 25 | Left pulmonary artery (medial basal branch) |
| 6 | Tracheal bifurcation | 26 | Lateral basal segmental bronchus |
| 7 | Left main bronchus | 27 | Right pulmonary artery (anterior basal branch) |
| 8 | Left pulmonary artery | 28 | Right pulmonary artery (medial basal branch) |
| 9 | Left upper lobe bronchus | 29 | Anterior basal segmental bronchus |
| 10 | Lingular bronchus | 30 | Medial basal segmental bronchus |
| 11 | Left pulmonary artery (superior lingular branch) | 31 | [Subapical segmental bronchus] |
| 12 | Apicoposterior segmental bronchus
(apical portion) | 32 | Right middle lobe bronchus |
| 13 | Apicoposterior segmental bronchus
(posterior portion) | 33 | Right pulmonary artery ([interlobar part]) |
| 14 | Left pulmonary artery, upper lobe branches
(posterior branch) | 34 | Right pulmonary artery
(anterior ascending branch) |
| 15 | Left pulmonary artery (superior trunk) | 35 | Anterior segmental bronchus |
| 16 | Anterior segmental bronchus | 36 | Right pulmonary artery, upper lobe branches
(anterior ascending branch) |
| 17 | Superior lingular bronchus | 37 | Right pulmonary artery, upper lobe branches
(apical branch) |
| 18 | Inferior lingular bronchus | 38 | Apical segmental bronchus [b] |
| 19 | Left pulmonary artery (inferior lingular branch) | 39 | Apical segmental bronchus [a] |
| 20 | Medial basal segmental bronchus | 40 | Trachea |

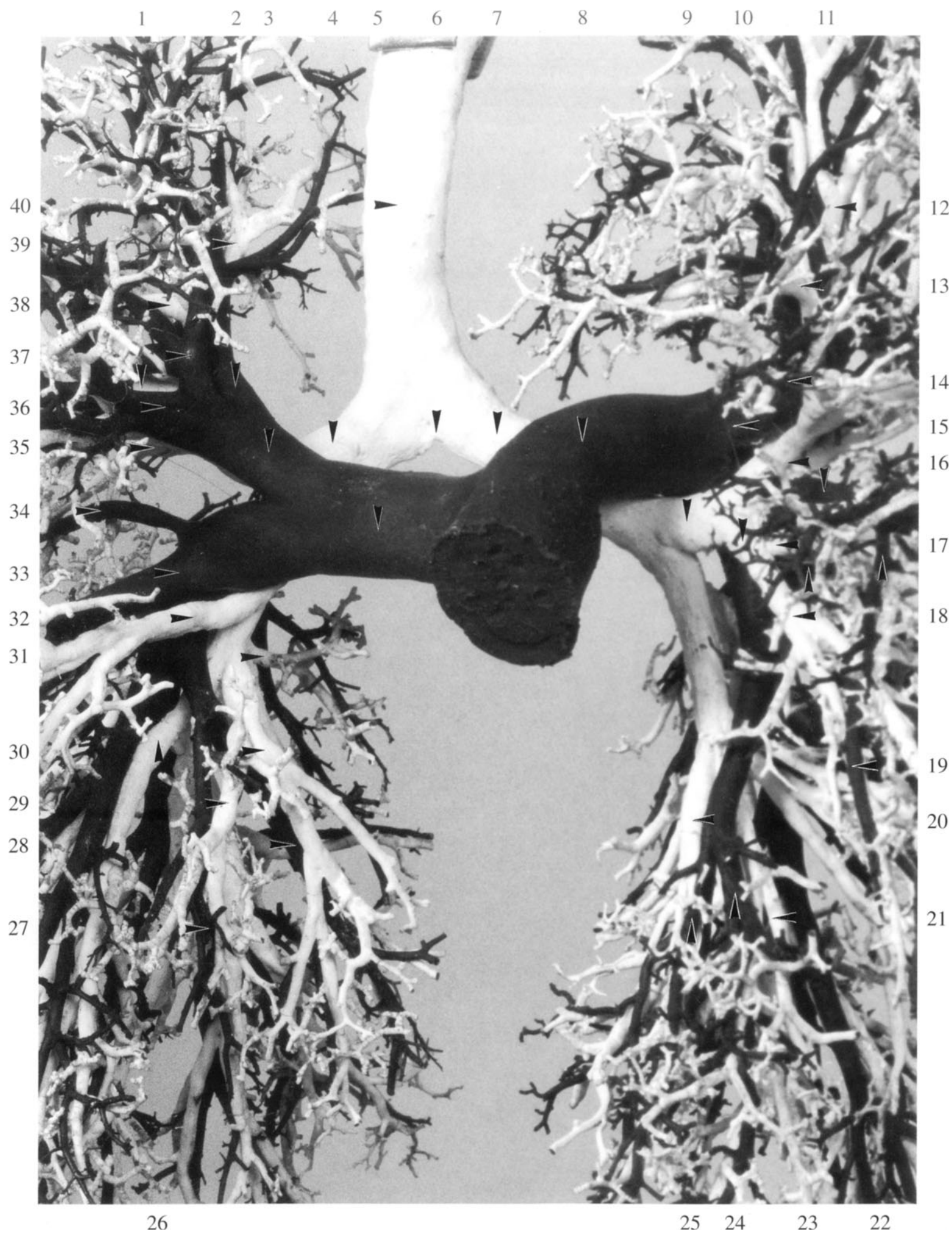


Figure 108 **Posterior Mediastinum 1**
Root of the Lung
Pulmonary Sulcus

- | | |
|---|--|
| 1 Greater supraclavicular fossa | 20 Right lung (lower lobe) |
| 2 Clavicle | 21 Inferior right pulmonary vein |
| 3 Clavicle (sternal end) | 22 Vertebral column |
| 4 Right brachiocephalic vein | with a posterior intercostal artery |
| 5 Anterior mediastinal lymph node | 23 Intervertebral disk covered by costal pleura |
| 6 Pericardiophrenic artery | 24 Joint of rib head covered by costal pleura |
| and anterior mediastinal lymph node | 25 Diaphragm covered by diaphragmatic pleura |
| 7 Inferior thyroid vein | 26 Inferior diaphragmatic artery (lateral branch) |
| 8 Posterior sternoclavicular ligament (cut surface) | 27 Sympathetic trunk covered by costal pleura |
| 9 Interclavicular ligament (cut surface) | 28 Anterior longitudinal ligament |
| 10 Clavicle (sternal articular surface) | 29 Azygos vein |
| 11 Trachea | 30 Posterior intercostal artery (bronchial branch) |
| 12 Unpaired thyroid plexus | 31 Phrenic nerve |
| 13 Left brachiocephalic vein | 32 Vagus nerve |
| 14 Internal thoracic vein (resected) | 33 Internal thoracic artery (resected) |
| 15 Superior vena cava | with origin of pericardiophrenic artery |
| 16 Right main bronchus | 34 Parietal pleura of pleural dome (cut edge) |
| 17 Vagus nerve (trunk of bronchial branches) | 35 Brachiocephalic trunk |
| 18 Esophagus with esophageal plexus | 36 Clavicle (sternal articular surface) |
| 19 Thoracic duct | 37 Right common carotid artery (origin) |

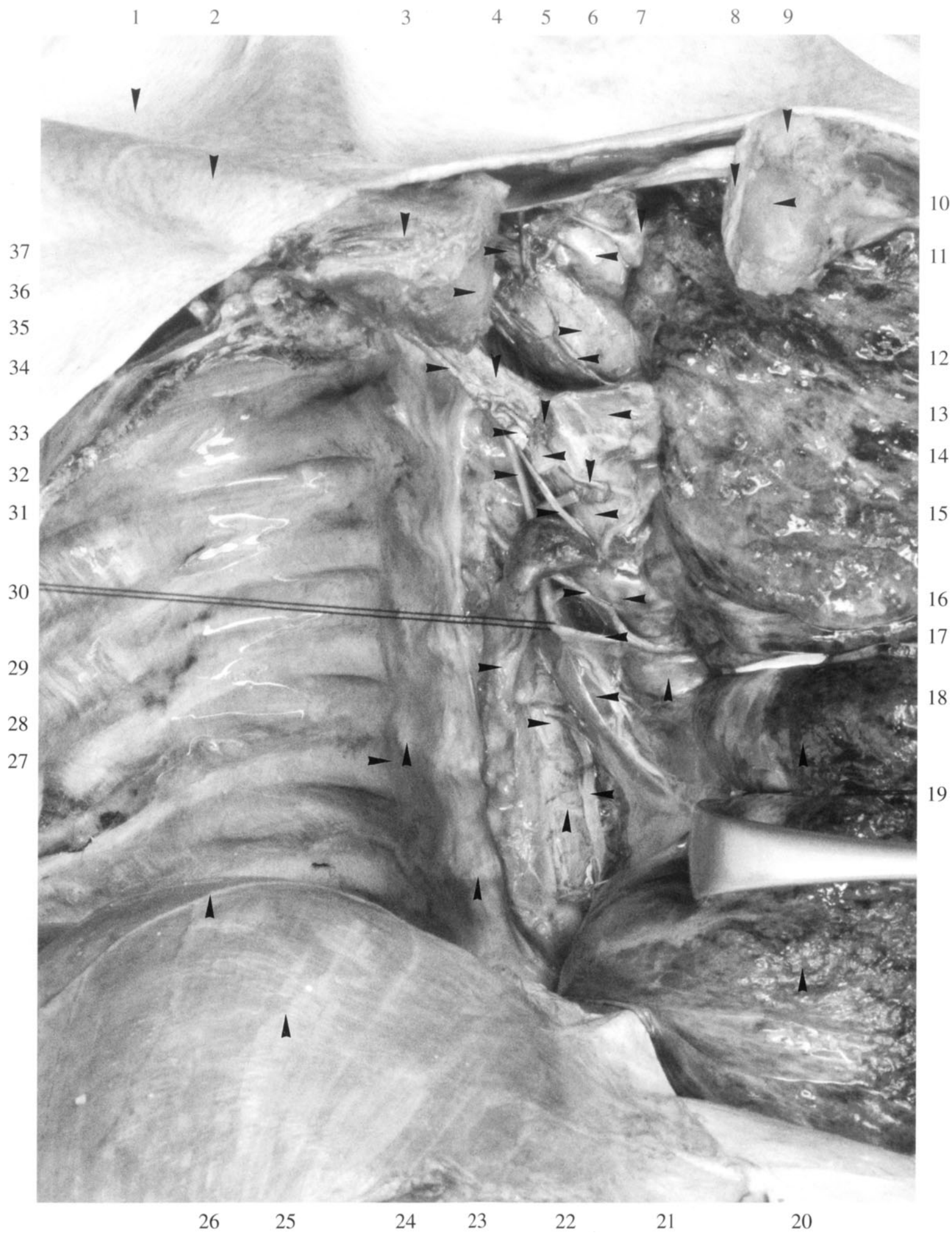


Figure 109

**Posterior Mediastinum 2
Region of Vertebral Column
Intercostal Spaces**

- | | |
|--|--|
| 1 Fifth posterior intercostal artery | 20 Prevertebral lymph node |
| 2 Fourth intercostal nerve
(muscular branch between external
and internal intercostal muscles) | 21 Right lung (lower lobe) |
| 3 Fifth intercostal nerve | 22 Pulmonary ligament |
| 4 Fourth posterior intercostal artery
(bronchial branch) | 23 Vagus nerve (bronchial branches) |
| 5 Right brachiocephalic vein | 24 Fifth posterior intercostal vein |
| 6 Internal thoracic artery (resected) | 25 Joint of head of rib (upper part) |
| 7 Superior vena cava
with apposed pericardiophrenic artery | 26 Internal intercostal muscle |
| 8 Clavicle (sternal articular surface) | 27 Intercostalis intimus muscle |
| 9 Trachea with unpaired thyroid plexus | 28 Diaphragm covered by diaphragmatic pleura |
| 10 Brachiocephalic trunk | 29 Intervertebral disk |
| 11 Right lung (upper lobe) | 30 Sympathetic trunk (communicating branch) |
| 12 Vagus nerve | 31 Sympathetic trunk |
| 13 Node of azygos venous arch | 32 Intercostal lymph node |
| 14 Right main bronchus | 33 Intercostal lymph node |
| 15 Bronchial branch | 34 Fourth posterior intercostal artery
(bronchial branch) |
| 16 Inferior right pulmonary vein | 35 Third posterior intercostal artery and vein |
| 17 Azygos vein | 36 Phrenic nerve |
| 18 Esophagus with esophageal plexus | 37 Internal thoracic artery |
| 19 Thoracic duct | 38 Subclavian artery |
| | 39 Common carotid artery |
| | 40 Clavicle |

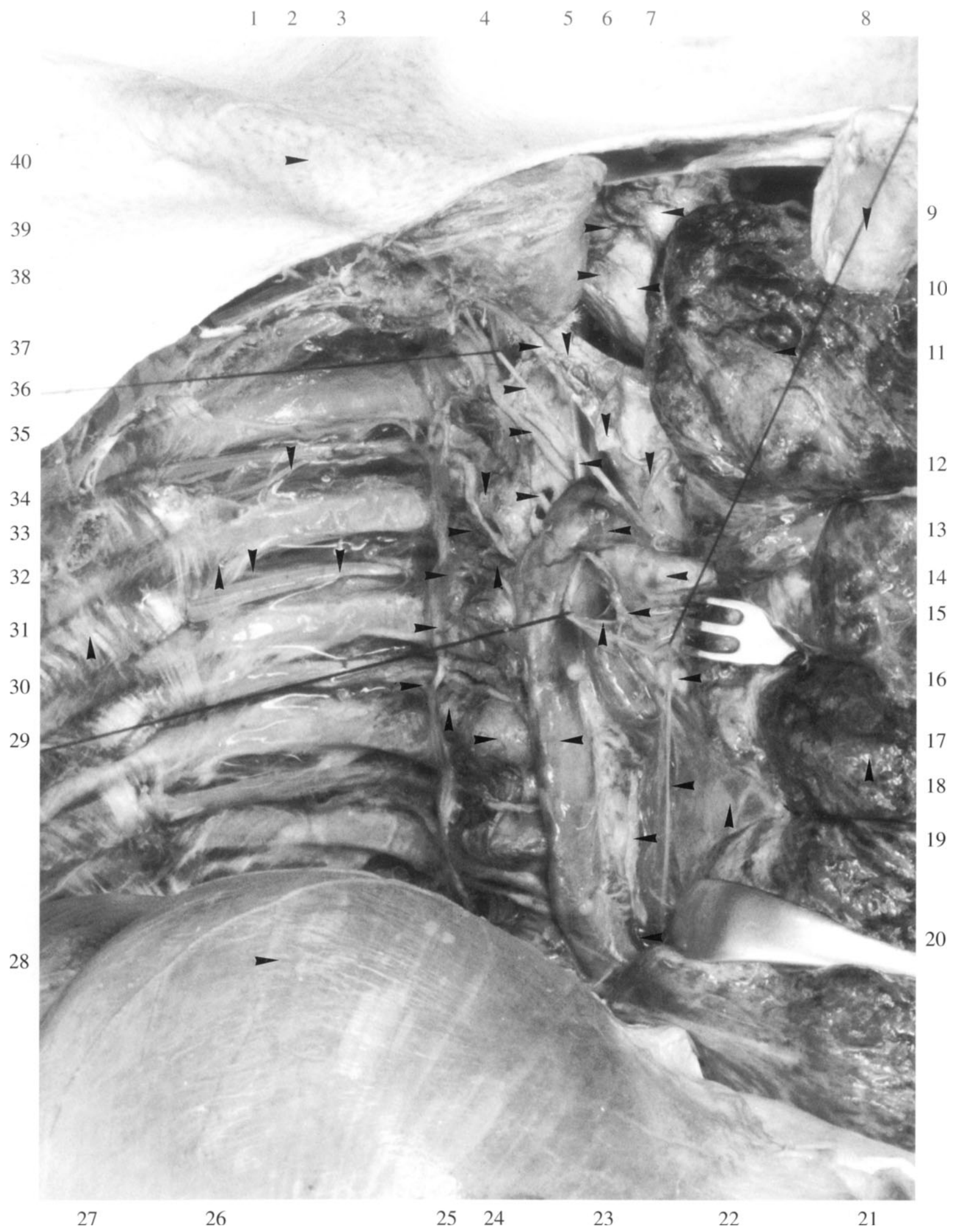


Figure 110**Posterior Mediastinum 3
Root of the Lung
Pulmonary Sulcus**

- | | |
|--|---|
| 1 Left pulmonary artery | 22 Greater splanchnic nerve |
| 2 Aortic arch | 23 Diaphragm covered by diaphragmatic pleura |
| 3 Left brachiocephalic vein | 24 Sixth posterior intercostal artery |
| 4 Common carotid artery (left) | 25 Intervertebral disk |
| 5 Accessory hemiazygos vein | 26 Bronchial branch of thoracic aorta |
| 6 Accessory hemiazygos vein | 27 Left main bronchus |
| 7 Fourth posterior intercostal artery and vein | with tracheobronchial lymph nodes |
| 8 Fourth intercostal nerve | 28 Inferior left pulmonary vein |
| 9 Esophagus | 29 Diaphragmatic part of pericardium |
| 10 Body of third rib | 30 Esophageal plexus [chordae oesophageae] |
| 11 Internal thoracic artery (resected) | 31 Inferior left pulmonary vein (superior branch) |
| 12 Esophagus | 32 Left lower lobe bronchus |
| 13 Thoracic duct | 33 Left upper lobe bronchus |
| 14 Vagus nerve | 34 Bronchial branch of thoracic aorta |
| 15 Recurrent laryngeal nerve | 35 Ligamentum arteriosum (of BOTALLI) |
| 16 Endothoracic fascia (cut edge) | 36 Thymic vein |
| 17 Thoracic aorta | 37 Pericardiacophrenic artery |
| 18 Sympathetic trunk (communicating branch) | 38 Phrenic nerve |
| 19 Hemiazygos vein | 39 Subclavian artery (left) |
| 20 Sympathetic trunk | 40 Trachea with inferior thyroid vein |
| 21 Esophagus with visceral fascia | |

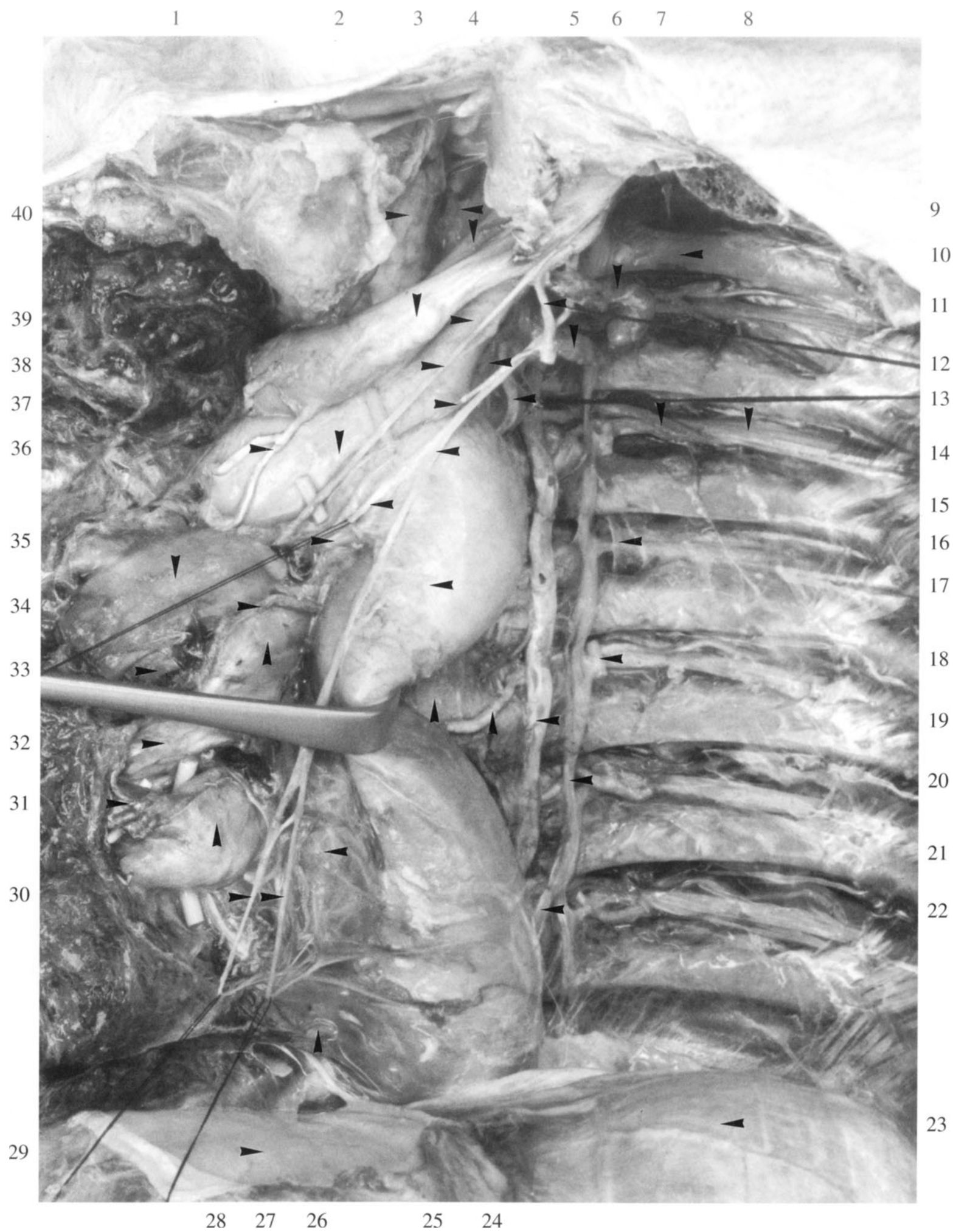


Figure 111**Pericardium 1
Relations and Outer Surface**

- | | | | |
|----|---|----|---|
| 1 | Horizontal fissure of right lung (fused) | 20 | Angular incisure |
| 2 | Oblique fissure | 21 | Greater curvature of stomach |
| 3 | Right lung (upper lobe) | 22 | Splenic omentum of gastrosplenic ligament |
| 4 | Root of lung | 23 | Gastric fundus |
| 5 | Mediastinal pleura (pericardial pleura) | 24 | Costal part of diaphragm (cut surface) |
| 6 | Costomediastinal recess (lateral border) | 25 | Planum cardiacum |
| 7 | Retrosternal fat pad | 26 | Lesser omentum (hepatogastric ligament) |
| 8 | Pericardiacophrenic vein | 27 | Liver (inferior border) |
| 9 | Left lung (upper lobe) | 28 | Left lobe of liver |
| 10 | Lingula of left lung (interlobar surface) | 29 | Round ligament of liver |
| 11 | Costomediastinal recess (lateral border) | 30 | Pylorus |
| 12 | Mediastinal pleura (pericardial pleura) | 31 | Falciform ligament of liver (cut edge) |
| 13 | Costomediastinal recess (lateral border) | 32 | Right lobe of liver |
| 14 | Inferior interpleural area | 33 | Sternal part of diaphragm (cut surface) |
| 15 | Costomediastinal recess (lateral border) | 34 | Phrenicomediastinal recess
with folds of pleural fat |
| 16 | Mediastinal pleura (pericardial pleura)
without subpleural fat | 35 | Right lung (lower lobe) |
| 17 | Phrenicomediastinal recess
with folds of pleural fat | 36 | Costomediastinal recess (lateral border) |
| 18 | Lesser curvature of stomach | 37 | Right lung (middle lobe) |
| 19 | Body of stomach | 38 | Costomediastinal recess (lateral border) |

1 2 3 4 5 6 7 8 9 10

38

37

36

35

34

33

32

31

30

11

12

13

14

15

16

17

18

19

20

29

28

27

26

25

24

23

22

21

Figure 112**Pericardium 2
Pericardial Cavity 1**

- | | | | |
|----|--------------------------------------|----|---|
| 1 | Left brachiocephalic vein | 15 | Diaphragm covered by diaphragmatic pleura |
| 2 | Clavicle (sternal articular surface) | 16 | Left coronary artery |
| 3 | First rib (cut surface) | | (right ventricular branch |
| 4 | Pericardiophrenic artery | | of anterior interventricular branch) |
| 5 | Internal thoracic vein | 17 | Right ventricle |
| 6 | Mediastinal pleura | 18 | Right marginal vein |
| 7 | Pulmonary trunk | 19 | Pericardium (sternocostal part) |
| 8 | Left atrial appendage | 20 | Right atrial appendage |
| 9 | Pericardium (lateral part) | 21 | Diaphragm covered by diaphragmatic pleura |
| 10 | Conus arteriosus | 22 | Right coronary artery (right marginal branch) |
| 11 | Left coronary artery | 23 | Coronary sulcus |
| | (collateral branch | | with anterior right ventricular branch |
| | of anterior interventricular branch) | 24 | Pericardium (lateral part) |
| 12 | Left ventricle | 25 | Right coronary artery (conus branch) |
| 13 | Left coronary artery | 26 | Superior vena cava |
| | (anterior interventricular branch) | 27 | Ascending aorta |
| 14 | Pericardium (diaphragmatic part) | 28 | Pericardium (apex) |

1 2

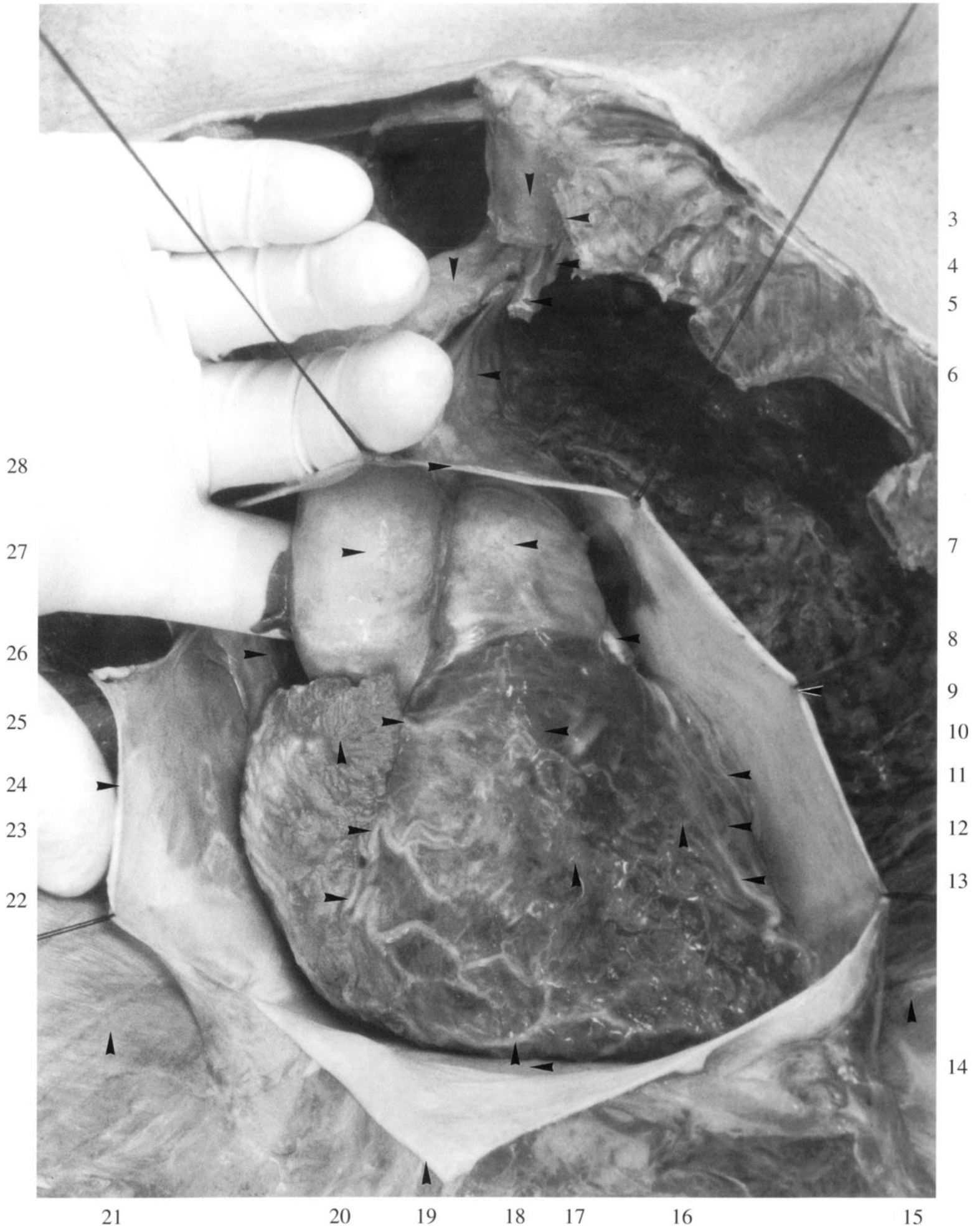


Figure 113 I **Pericardium 3**
Pericardial Cavity 2
Cardiac Vessels

- | | | | |
|----|---|----|--|
| 1 | Second rib (cut surface) | 20 | Inferior vena cava |
| 2 | Internal thoracic artery | 21 | Right coronary artery
(right posterolateral branch) |
| 3 | Clavicle (sternal articular surface) | 22 | Posterior vein of left ventricle |
| 4 | Brachiocephalic trunk | 23 | Right coronary artery
(posterior interventricular branch) |
| 5 | Aortic arch | 24 | Posterior interventricular vein
(middle cardiac vein) |
| 6 | Left brachiocephalic vein | 25 | Diaphragm covered by diaphragmatic pleura |
| 7 | Pericardium (cut edge) | 26 | Left coronary artery
(posterior left ventricular branch) |
| 8 | Clavicle (sternal articular surface) | 27 | Posterior vein of left ventricle |
| 9 | Inferior thyroid vein | 28 | Left coronary artery
(posterior left ventricular branch) |
| 10 | Internal thoracic vein | 29 | Left coronary artery
(posterior left ventricular branch) |
| 11 | Mediastinal pleura (cut edge) | 30 | Left coronary artery (left marginal branch) |
| 12 | Pericardiophrenic vein | 31 | Ascending aorta |
| 13 | Pulmonary trunk | 32 | Internal thoracic vein |
| 14 | Fold of left vena cava | 33 | Trachea |
| 15 | Left atrial appendage | | |
| 16 | Left coronary artery (atrial branch) | | |
| 17 | Left atrium | | |
| 18 | Coronary sinus | | |
| 19 | SAPPEY'S T
(junction of vertical and horizontal limbs) | | |



Figure 113 II **Pericardium 4**
Pericardial Cavity 3
Cardiac Vessels

- | | | | |
|----|---|----|--|
| 1 | Horizontal fissure (of right lung) | 18 | Left atrium |
| 2 | Superior vena cava | 19 | Inferior vena cava |
| 3 | Ascending aorta | 20 | Pericardium (diaphragmatic part) |
| 4 | Pulmonary trunk | 21 | Right border of heart |
| 5 | Left lung (upper lobe) | 22 | Folds of pleural fat in costodiaphragmatic recess |
| 6 | Fourth rib (cut surface) | 23 | Folds of pleural fat in phrenicomedial recess |
| 7 | Right ventricle (anterior surface of heart) | 24 | Posterior interventricular vein
(middle cardiac vein) |
| 8 | Anterior interventricular sulcus | 25 | Posterior vein of left ventricle |
| 9 | Cardiac apex | 26 | Posterior vein of left ventricle |
| 10 | Ascending aorta | 27 | Cardiac apex |
| 11 | Pulmonary trunk | 28 | Right border of heart |
| 12 | Left atrial appendage | 29 | Diaphragm covered by diaphragmatic pleura |
| 13 | Pericardium (lateral part, cut edge) | 30 | Pericardium (sternocostal part, cut edge) |
| 14 | Superior left pulmonary vein | 31 | Right atrial appendage |
| 15 | Inferior left pulmonary vein | 32 | Right lung (middle lobe) |
| 16 | Fold of left vena cava | | |
| 17 | Coronary sulcus | | |

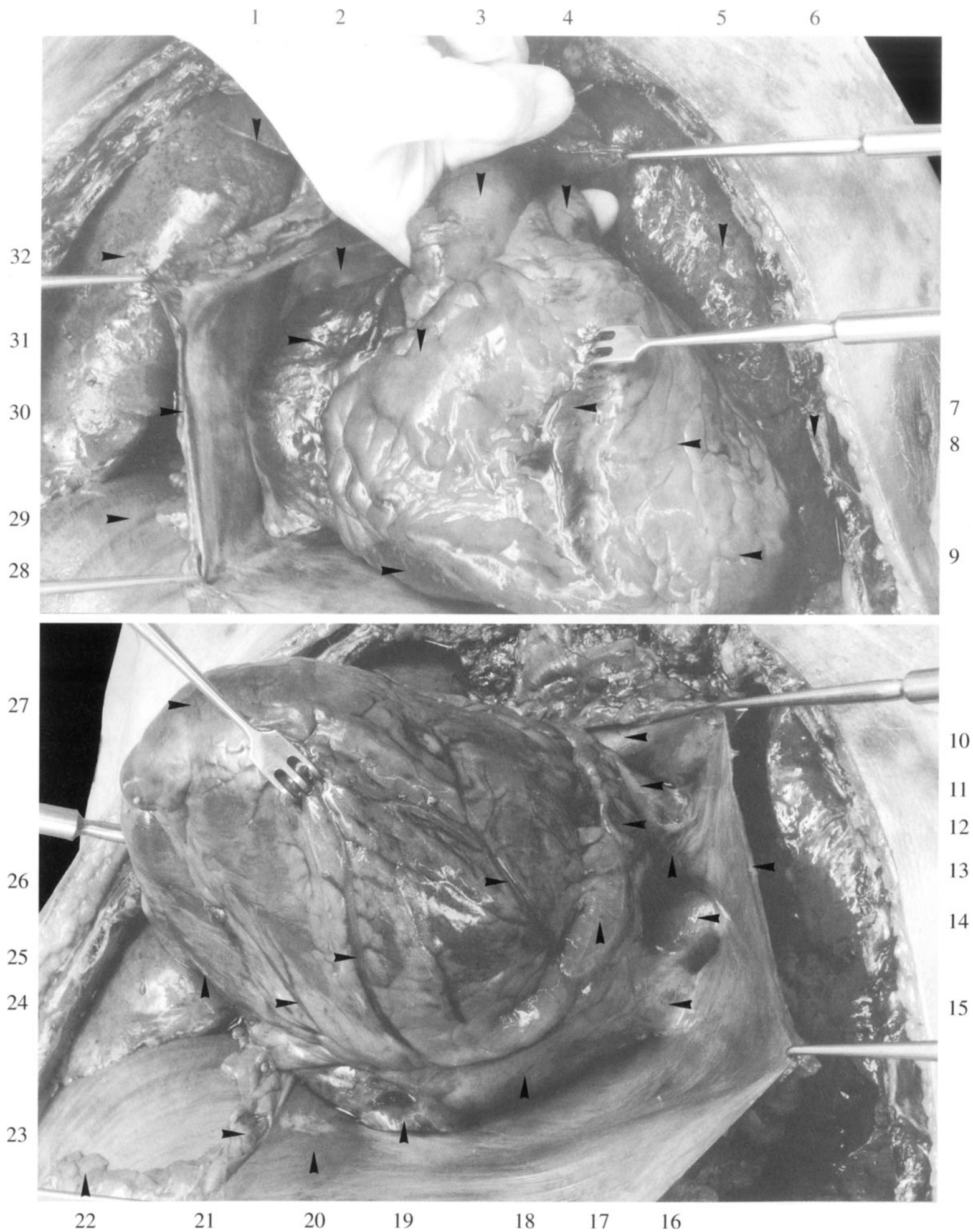
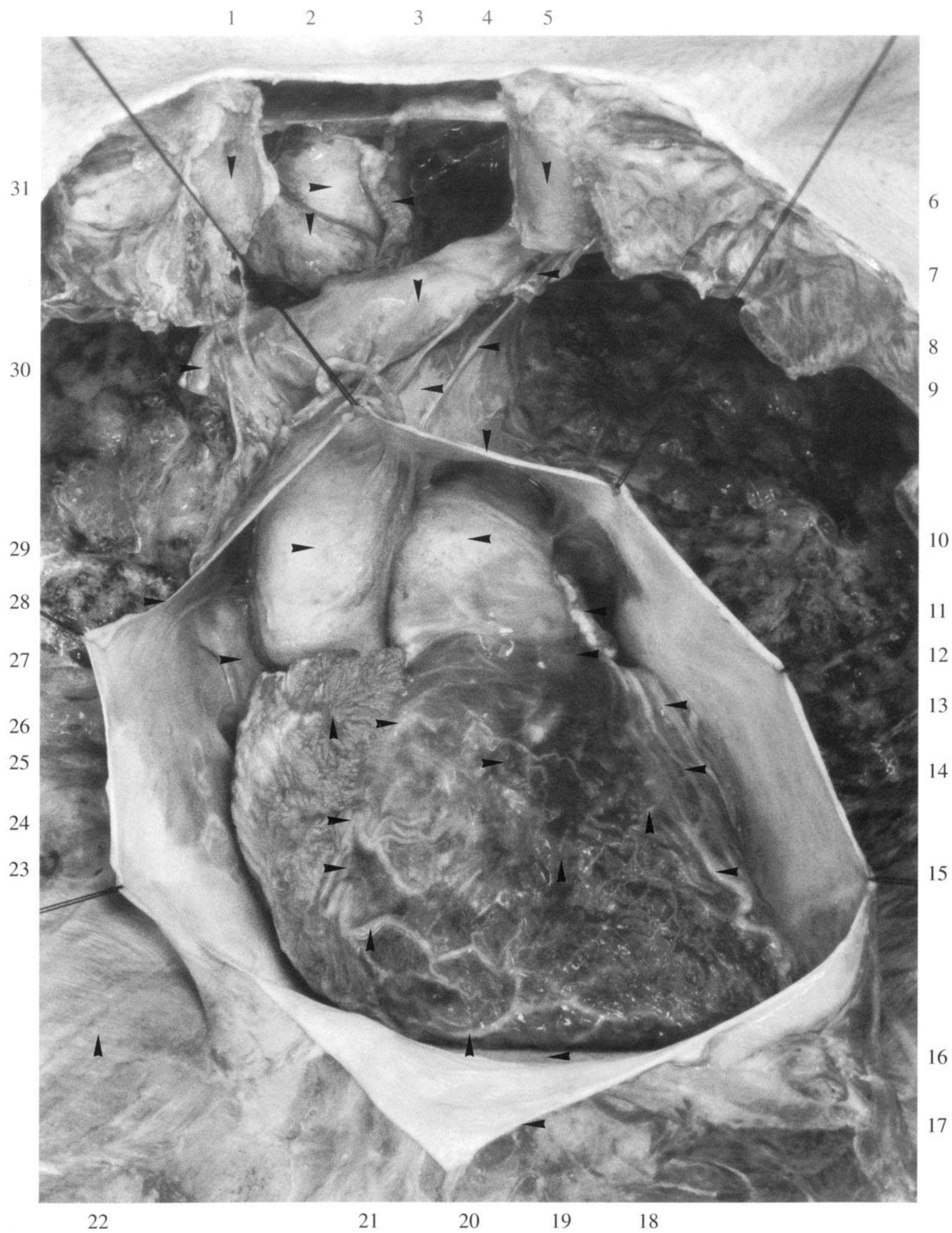


Figure 114

Heart 1
Cardiac Vessels

- | | | | |
|----|--|----|--|
| 1 | Clavicle (sternal articular surface) | 18 | Left coronary artery (right ventricular branch) |
| 2 | Brachiocephalic trunk | 19 | Right ventricle |
| 3 | Left brachiocephalic vein | 20 | Right marginal vein |
| 4 | Pericardium (apex) | 21 | Right coronary artery (right marginal branch) |
| 5 | Clavicle (sternal articular surface) | 22 | Diaphragm covered by diaphragmatic pleura |
| 6 | Inferior thyroid vein | 23 | Anterior vein of right ventricle
(anterior cardiac vein) |
| 7 | Internal thoracic vein | 24 | Right coronary artery
(anterior right ventricular branch)
with anterior vein of right ventricle
(anterior cardiac vein) |
| 8 | Mediastinal pleura (cut edge) | 25 | Conus arteriosus |
| 9 | Aortic arch | 26 | Right coronary artery (conus branch)
with anterior vein of right ventricle
(anterior cardiac vein) |
| 10 | Pulmonary trunk | 27 | Superior vena cava |
| 11 | Left atrial appendage | 28 | Pericardium (lateral part) |
| 12 | Left coronary artery (conus branch) | 29 | Ascending aorta |
| 13 | Left coronary artery
(collateral branch
of anterior interventricular branch) | 30 | Internal thoracic vein |
| 14 | Left ventricle with anterior interventricular vein | 31 | Trachea |
| 15 | Left coronary artery
(anterior interventricular branch) | | |
| 16 | Pericardium (diaphragmatic part) | | |
| 17 | Pericardium (sternocostal part) | | |



- | | | | |
|----|---|----|---|
| 1 | Clavicle (sternal articular surface) | 19 | Right ventricle |
| 2 | Brachiocephalic trunk | 20 | Right marginal vein |
| 3 | Left brachiocephalic vein | 21 | Right coronary artery (right marginal branch) |
| 4 | Pericardium (apex) | 22 | Anterior veins of right ventricle
(anterior cardiac veins) |
| 5 | Clavicle (sternal articular surface) | 23 | Right atrium |
| 6 | Inferior thyroid vein | 24 | Right atrial appendage |
| 7 | Internal thoracic vein | 25 | Diaphragm covered by diaphragmatic pleura |
| 8 | Mediastinal pleura (cut edge) | 26 | Pericardium
(diaphragmatic attachment with anterior branch
of pericardiophrenic artery) |
| 9 | Aortic arch | 27 | Coronary sulcus |
| 10 | Pulmonary trunk | 28 | Right coronary artery
with origin of right marginal branch |
| 11 | Pericardium (lateral part) | 29 | Right coronary artery
(anterior branch of right ventricle) |
| 12 | Left atrial appendage | 30 | Right coronary artery (sinoatrial nodal branch) |
| 13 | Conus arteriosus
with right and left conus arteries | 31 | Right coronary artery
with origin of conus branch |
| 14 | Left coronary artery (collateral branch
of anterior interventricular branch) | 32 | Serous pericardium (cut edge of visceral layer) |
| 15 | Left coronary artery
(anterior interventricular branch) | 33 | Superior vena cava |
| 16 | Planum cardiacum
with diaphragmatic part of pericardium | 34 | Ascending aorta |
| 17 | Pericardium (sternocostal part) | 35 | Superior vena cava |
| 18 | Left coronary artery
(right ventricular branch
of anterior interventricular branch) | 36 | Trachea |

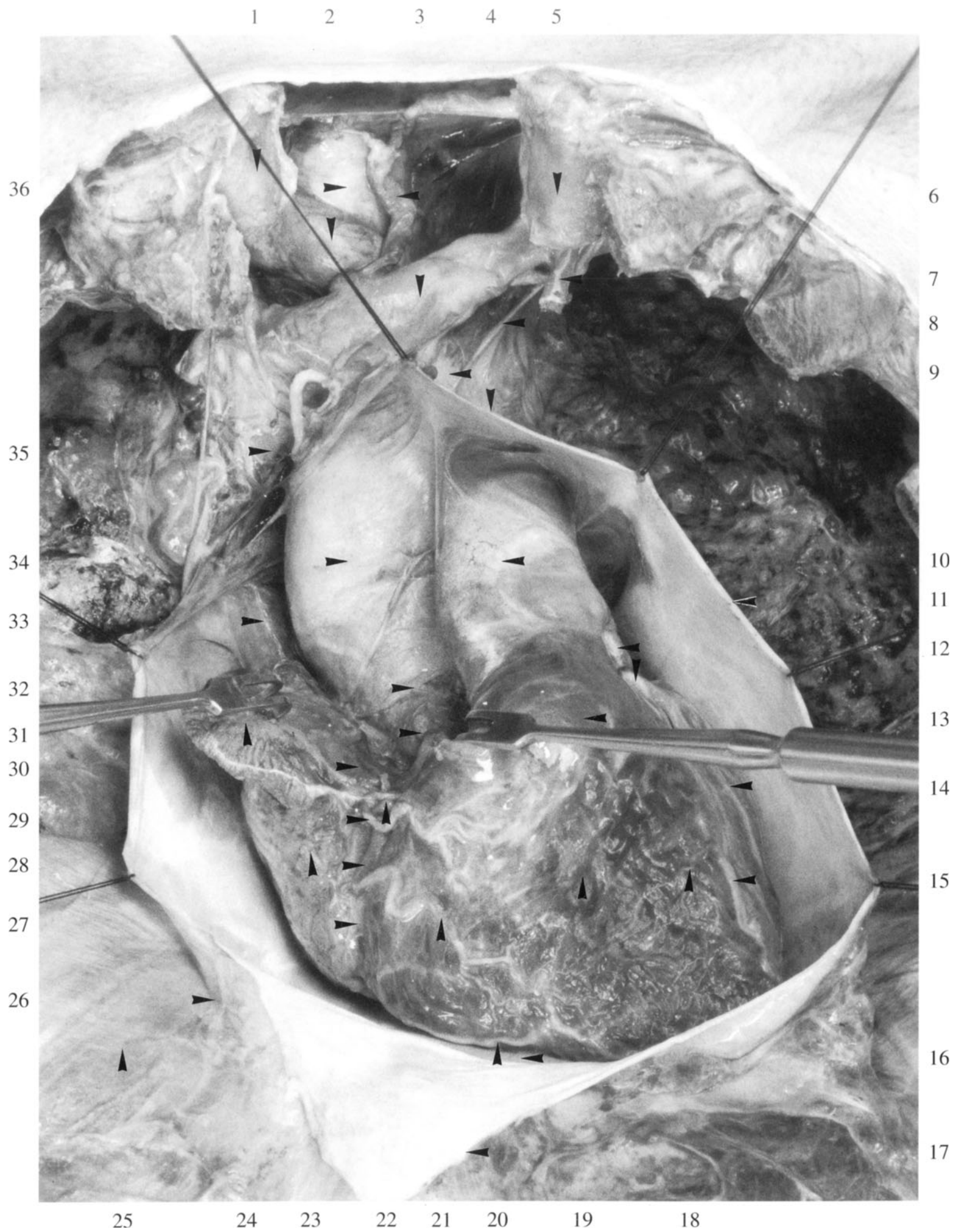


Figure 116

Heart 3
Locating the Right Coronary Artery 2

- | | | | |
|----|--|----|---|
| 1 | Internal thoracic artery | 18 | Right coronary artery (conus branch) |
| 2 | Manubrium sterni (cut surface) | 19 | Right coronary artery (sinoatrial nodal branch) |
| 3 | Ascending aorta | 20 | Diaphragm (costal part) |
| 4 | Internal thoracic artery | 21 | Right atrial appendage |
| 5 | Pericardium (cut edge) | 22 | Diaphragm covered by diaphragmatic pleura |
| 6 | Sternocleidomastoid muscle | 23 | Rectus abdominis muscle (cut surface) |
| 7 | Left atrial appendage | 24 | Superior epigastric artery |
| 8 | Aortic sinus (right) | 25 | Diaphragm (sternal part) |
| 9 | Conus branch | 26 | Right border of heart |
| 10 | Conus arteriosus | 27 | Pericardium (lateral part) |
| 11 | Anterior interventricular veins | 28 | Coronary sulcus |
| 12 | Right ventricle | 29 | Right atrium |
| 13 | Diaphragm (costal part) | 30 | Epicardium (cut surface) |
| 14 | Superior epigastric artery | 31 | Right coronary artery |
| 15 | Cardiac apex | 32 | Epicardium (cut surface) |
| 16 | Left coronary artery (right ventricle branch
of anterior interventricular branch) | 33 | Superior vena cava |
| 17 | Pericardium (sternocostal part) | 34 | Parietal pleura (costal part, cut edge) |
| | | 35 | Left brachiocephalic vein |
| | | 36 | Sternocleidomastoid muscle |



- | | |
|--|--|
| 1 Internal thoracic artery | 17 Anterior interventricular vein |
| 2 Conus arteriosus | 18 Pericardium (sternocostal part) |
| 3 Epicardium (cut edge) | 19 Diaphragm (costal part) |
| 4 Pulmonary trunk | 20 Rectus abdominis muscle (cut surface) |
| 5 Left coronary artery
(circumflex branch, covered by subepicardial fat) | 21 Diaphragm (sternal part) |
| 6 Left atrial appendage | 22 Cardiac apex |
| 7 Manubrium sterni (cut surface) | 23 Left ventricle (diaphragmatic surface)
[inferior surface] |
| 8 Ascending aorta between attachments
of serous pericardium and fibrous pericardium | 24 Anterior interventricular sulcus |
| 9 Left coronary artery (collateral branch
of anterior interventricular branch) | 25 Left coronary artery
(lateral branch [diagonal branch]
of anterior interventricular branch) |
| 10 Pericardium (lateral part) | 26 Right ventricle (sternocostal surface)
[anterior surface] |
| 11 Left ventricle (pulmonary surface) | 27 Fibrous pericardium with serous pericardium
(cut edge) |
| 12 Left coronary artery
(posterior left ventricular branch) | 28 Ascending aorta with aortic recess |
| 13 Planum cardiacum
with diaphragmatic part of pericardium | 29 Serous pericardium (cut edge) |
| 14 Diaphragm (costal part) | 30 Left brachiocephalic vein
in superior interpleural area |
| 15 Superior epigastric artery | |
| 16 Left coronary artery
(anterior interventricular branch) | |

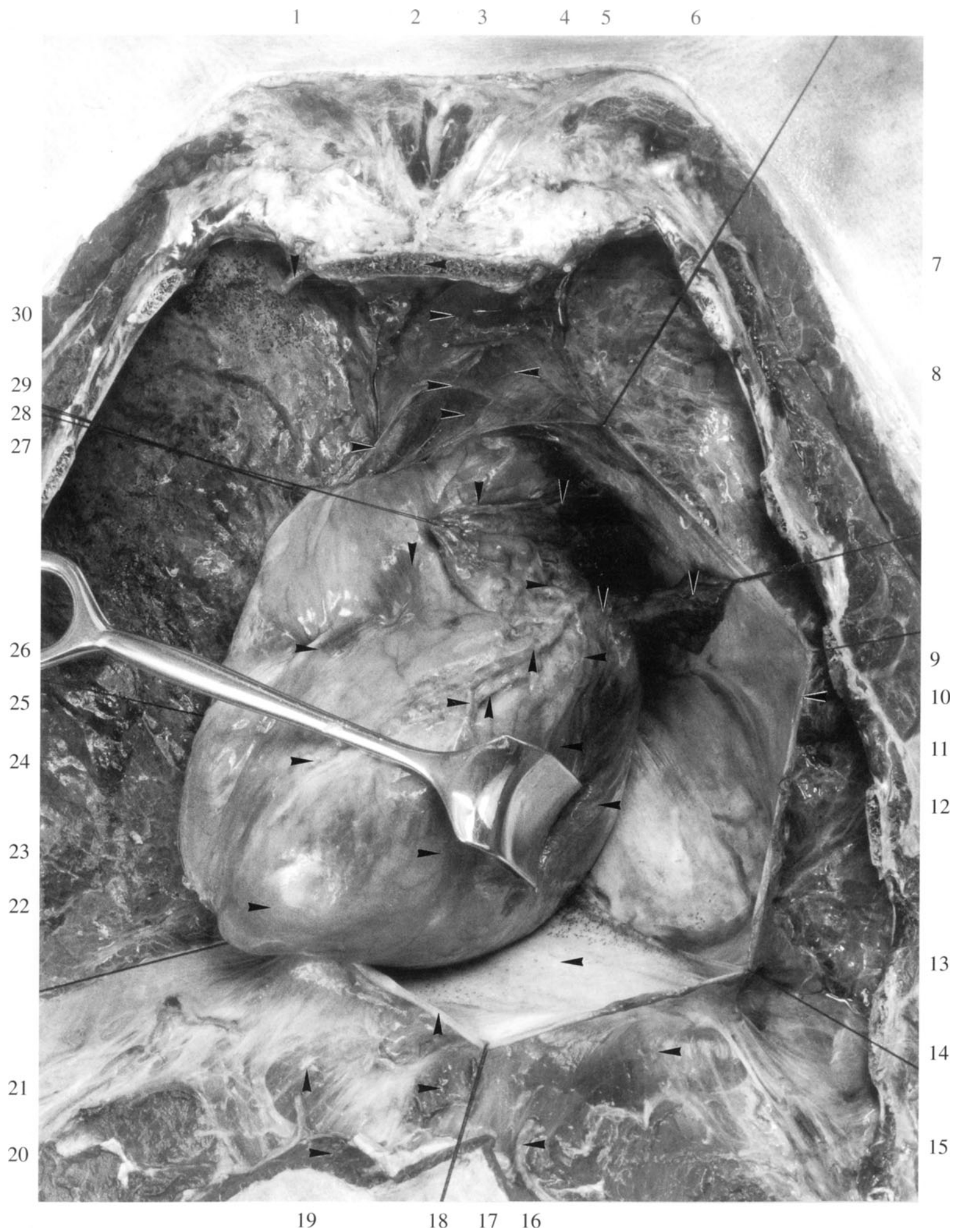
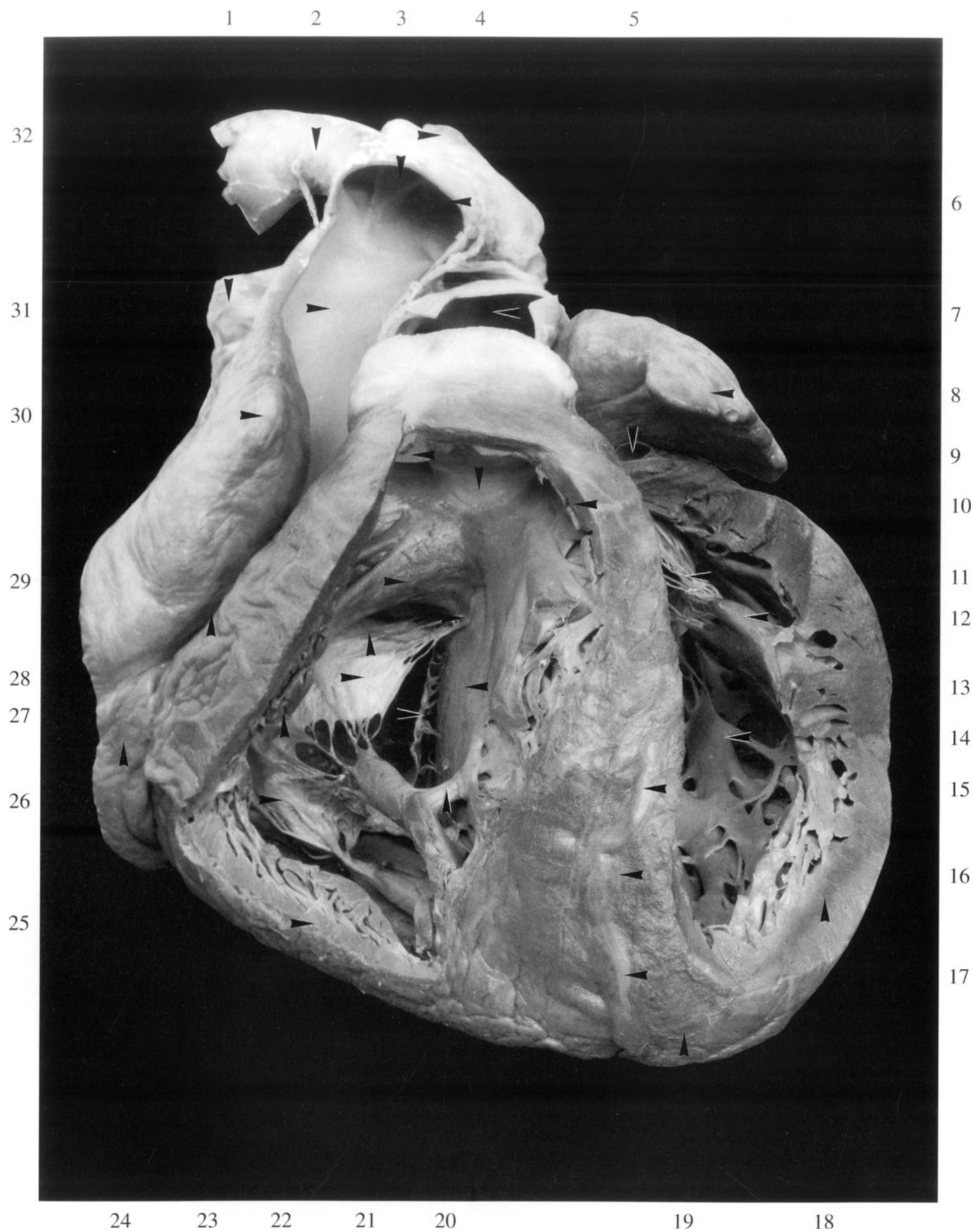


Figure 118

**Heart 5
Right Ventricle**

- | | | | |
|----|--|----|--|
| 1 | Right pulmonary artery | 17 | Anastomosis of anterior |
| 2 | Pulmonary trunk | | and posterior interventricular veins |
| 3 | Left common carotid artery (origin) | 18 | Myocardium of left ventricle (cut surface) |
| 4 | Pulmonary valve (left cusp) | 19 | Cardiac apex |
| 5 | Left coronary vein [great cardiac vein] | 20 | Septomarginal trabecula |
| 6 | Aortic arch | 21 | Anteroseptal commissure |
| 7 | Pulmonary trunk (crotch at bifurcation) | 22 | Anteroposterior commissure |
| 8 | Left atrial appendage | 23 | Coronary sulcus |
| 9 | Pulmonary valve (right cusp) | 24 | Right atrium |
| 10 | Myocardium of conus arteriosus (cut surface) | 25 | Myocardium of right ventricle |
| 11 | Chordae tendineae | 26 | Posterior cusp |
| 12 | Anterior papillary muscle | 27 | Septal cusp |
| 13 | Interventricular septum (muscular part) | 28 | Anterior cusp |
| 14 | Left ventricle with trabeculae carnae | 29 | Supraventricular crest |
| 15 | Anterior interventricular vein | 30 | Right atrial appendage |
| 16 | Anterior interventricular sulcus | 31 | Ascending aorta |
| | | 32 | Left subclavian artery |



- | | | | |
|----|---|----|---|
| 1 | Coronary sulcus | 21 | Left ventricle with trabeculae carneae (outflow tract) |
| 2 | Myocardium of conus arteriosus (cut surface) | 22 | Anterior interventricular vein |
| 3 | Brachiocephalic trunk | 23 | Right atrioventricular valve (tricuspid valve) (posteroseptal commissure) |
| 4 | Brachiocephalic trunk (origin) | 24 | Posterior papillary muscle (posterior division) |
| 5 | Crotch between brachiocephalic trunk and left common carotid artery | 25 | Anastomosis between anterior and posterior interventricular veins |
| 6 | Left subclavian artery | 26 | Anterior interventricular sulcus |
| 7 | Left atrial appendage | 27 | Trabeculae carneae of right ventricle (cut surface) |
| 8 | Crotch between left common carotid artery and left subclavian artery | 28 | Septomarginal trabecula |
| 9 | Left pulmonary artery | 29 | Anterior papillary muscle of right ventricle |
| 10 | Pulmonary trunk (opened) | 30 | Posterior cusp of tricuspid valve |
| 11 | Left coronary artery (resected) | 31 | Right atrioventricular valve (tricuspid valve) (anteroposterior commissure) |
| 12 | Pulmonary valve (left semilunar valve) | 32 | Anterior cusp of tricuspid valve |
| 13 | Left atrioventricular valve (mitral valve, bicuspid valve) (anterolateral commissure) | 33 | Right atrioventricular valve (tricuspid valve) (anteroseptal commissure) |
| 14 | Anterior cusp of mitral valve | 34 | Supraventricular crest |
| 15 | Anterior papillary muscle | 35 | Pulmonary valve (right cusp) |
| 16 | Anterior papillary muscle (attachment to compact layer of myocardium) | 36 | Right atrial appendage |
| 17 | Posterior papillary muscle | 37 | Pulmonary trunk (crotch at bifurcation) |
| 18 | Myocardium of left ventricle (cut surface) | 38 | Ascending aorta (inner surface of posterior wall) |
| 19 | Cardiac apex and its relation to the ventricles | | |
| 20 | Posterior cusp of mitral valve | | |

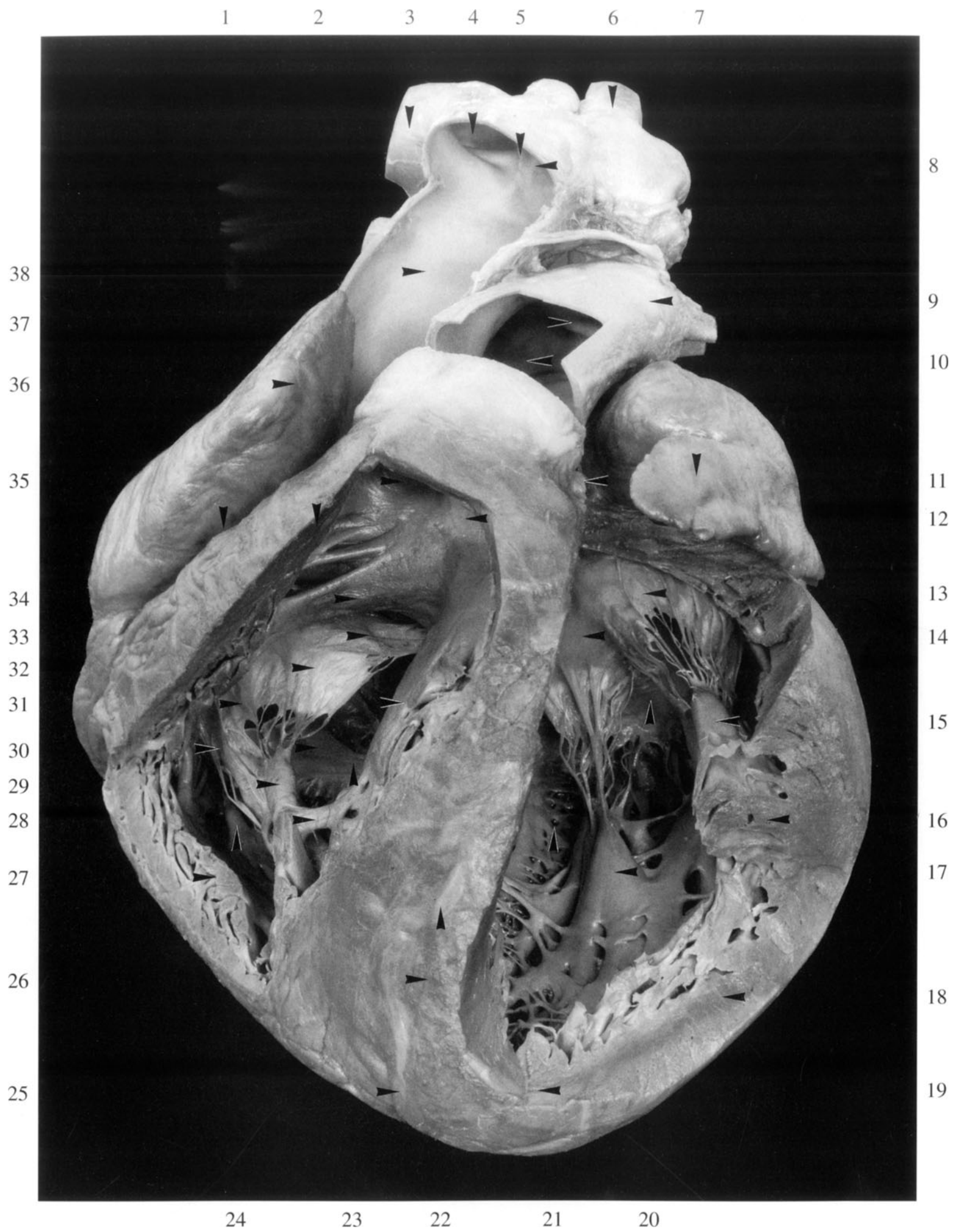


Figure 120

**Heart 7
Luminal Casts**

- | | |
|--|---|
| 1 Ascending aorta | 9 Conus arteriosus of right ventricle |
| 2 Pulmonary trunk | 10 Right ventricle |
| 3 Left atrium | 11 Right atrium |
| 4 Pulmonary valve (bulge of anterior cusp) | 12 Anterior papillary muscle (impression) |
| 5 Left atrial appendage | 13 Coronary sulcus |
| 6 Pulmonary valve (bulge of left cusp) | 14 Right atrial appendage |
| 7 Left aortic sinus | 15 Pulmonary valve (bulge of right cusp) |
| 8 Left ventricle | |



Figure 121

Heart 8
Right and Left Atria

- | | | | |
|----|---|----|---|
| 1 | Right atrial appendage | 18 | Posterior vein of left ventricle |
| 2 | Crista terminalis | 19 | Coronary sinus |
| 3 | Atrioventricular septum | 20 | Left atrium (cut surface of wall) |
| 4 | Septal cusp of tricuspid valve | 21 | Left coronary artery
(posterior left ventricular branch
of circumflex branch) |
| 5 | Anterior cusp of tricuspid valve | 22 | Coronary sulcus with vessels |
| 6 | Posterior cusp of tricuspid valve | 23 | Left ventricle |
| 7 | Crista terminalis (cut surface) | 24 | Left ventricle (diaphragmatic surface)
[inferior surface] |
| 8 | Pectinate muscles (cut surfaces) | 25 | Left atrium
(cut surface of wall with atrial branches) |
| 9 | Right ventricle (diaphragmatic surface)
[inferior surface] | 26 | Left atrial appendage |
| 10 | Right atrioventricular orifice | 27 | Superior vena cava |
| 11 | Pericardium | 28 | Ascending aorta |
| 12 | Inferior vena cava | 29 | Right atrium (posterior wall) |
| 13 | Interatrial septum | 30 | Crista terminalis |
| 14 | Anterior cusp of mitral valve | 31 | Sulcus terminalis |
| 15 | Left atrioventricular orifice | 32 | Pectinate muscles in right atrial appendage |
| 16 | Posterior cusp of mitral valve | | |
| 17 | Posterior interventricular vein
[middle cardiac vein] | | |

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

32

31

30

29

28

27

26

25

24

23

22

21

20

19

Figure 122

Heart 9
Semilunar Valves
Interatrial Septum

- | | |
|---|---|
| 1 Left atrial appendage | 21 Right ventricle (diaphragmatic surface) |
| 2 Pulmonary valve (anterior cusp) | [inferior surface] |
| 3 Pulmonary valve (left cusp) | 22 Pectinate muscles (cut surfaces) |
| 4 Pulmonary valve (right cusp) | 23 KOCH's triangle |
| 5 Aortic valve (right cusp) | 24 Valve of coronary sinus [THEBESIAN valve] |
| 6 Ascending aorta | 25 Valve of inferior vena cava [EUSTACHIAN valve] |
| 7 Coronary sulcus | 26 Inferior vena cava |
| 8 Right atrial appendage | 27 Crista terminalis (caudal end) |
| 9 Aortic valve (posterior cusp) | 28 Fossa ovalis |
| 10 Right atrial appendage | 29 Limbus of fossa ovalis |
| (location of sinoatrial node) | 30 Intervenous tubercle |
| 11 Superior vena cava | 31 Orifice of superior vena cava |
| 12 Right atrial appendage | 32 Crista terminalis (cut surface) |
| 13 Pectinate muscles | 33 Superior vena cava |
| 14 Right coronary artery (right marginal branch) | 34 Pericardium |
| 15 Interatrial septum | 35 Pulmonary trunk |
| 16 Right ventricle with trabeculae carneae | 36 Left coronary artery |
| 17 Septal cusp of tricuspid valve (septal attachment) | 37 Left ventricle |
| 18 Orifice of coronary sinus | 38 Nodule of anterior cusp |
| 19 Crista terminalis (cut surface) | 39 Right ventricle (conus arteriosus) |
| 20 Right ventricle (right cardiac border) | |

1

2

3

4

5

6

7

39

38

37

36

35

8

9

10

11

34

33

32

31

30

29

28

27

12

13

14

15

16

17

18

19

26

25

24

23

22

21

20

Figure 123

**Infraclavicular Region 1
Clavipectoral Triangle**

- | | | | |
|----|--|----|---|
| 1 | Deltoid muscle | 18 | Lesser supraclavicular fossa |
| 2 | Skin (cut surface) | 19 | Clavicle |
| 3 | Deltoid muscle with superficial deltoid fascia | 20 | Superficial pectoral fascia |
| 4 | Clavipectoral triangle
[deltoideopectoral triangle (of MOHRENHEIM)] | 21 | Thoracoacromial artery (deltoid branch) |
| 5 | Trapezius muscle | 22 | Cephalic vein |
| 6 | Greater supraclavicular fossa | 23 | Deltoideopectoral sulcus |
| 7 | Lesser supraclavicular fossa | 24 | Axillary fossa |
| 8 | Sternocleidomastoid muscle | 25 | Deltoid muscle |
| 9 | Clavicle | 26 | Medial bicipital sulcus |
| 10 | Pectoralis major muscle
with superficial pectoral fascia | 27 | Anterior axillary fold |
| 11 | First rib | 28 | Deep layer of stratum subcutaneum |
| 12 | Trapezius muscle | 29 | Clavipectoral fascia |
| 13 | Sternocleidomastoid muscle | 30 | Deltoid muscle |
| 14 | Greater supraclavicular fossa | 31 | Superficial deltoid fascia |
| 15 | Pectoralis major muscle | 32 | Acromion |
| 16 | First rib | 33 | Posterior axillary fold |
| 17 | Subcutaneous tissue (cut surface) | 34 | Axillary fossa |
| | | 35 | Deep layer of stratum subcutaneum |
| | | 36 | Deltoideopectoral sulcus |
| | | 37 | Acromion |

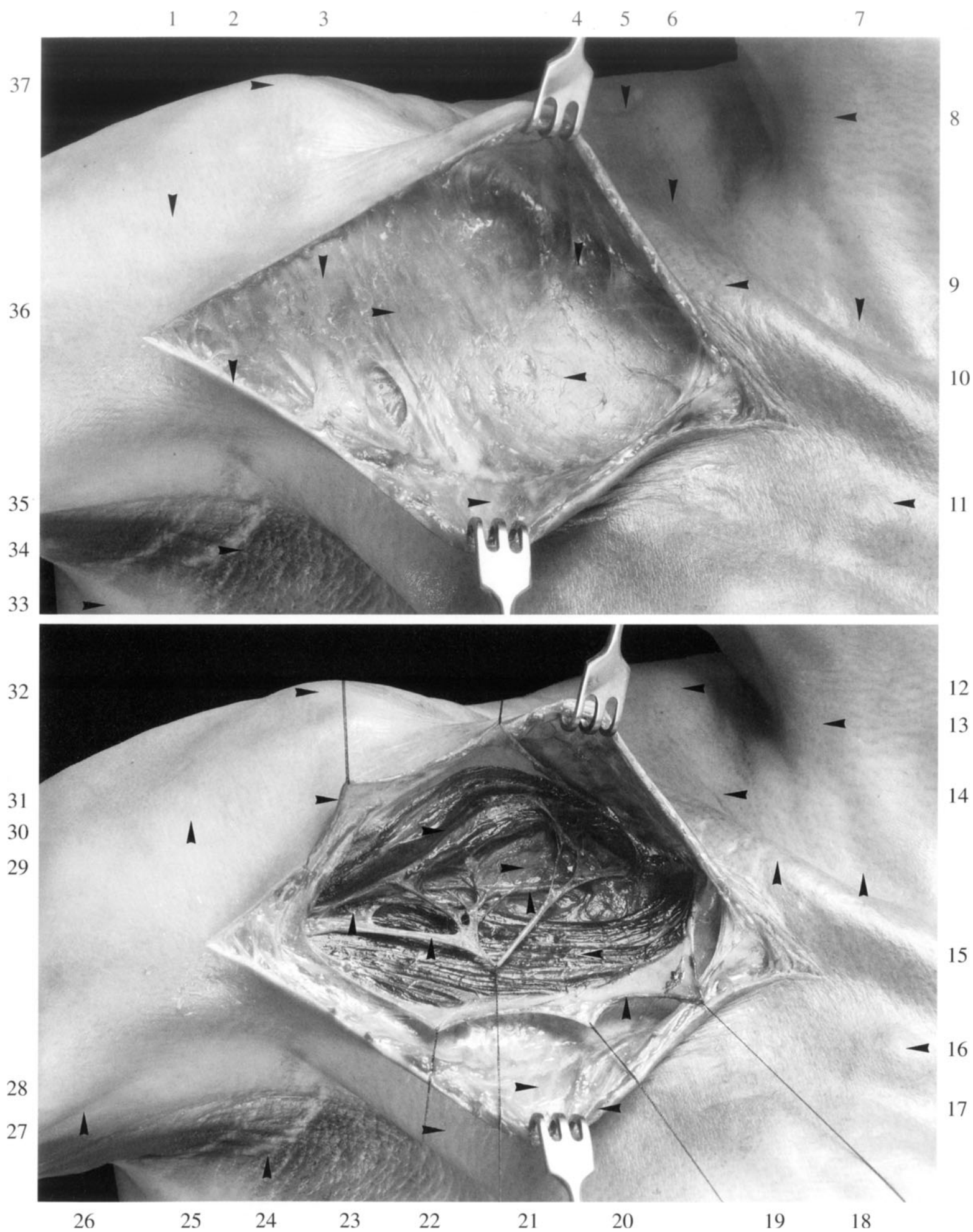


Figure 124

**Infraclavicular Region 2
Pectoralis Major Muscle**

- | | | | |
|---|--|----|---|
| 1 | Deltoid muscle | 10 | Trapezius muscle |
| 2 | Thoracoacromial artery (deltoid branch) | 11 | Pectoralis major muscle (clavicular part) |
| 3 | Cephalic vein | 12 | Clavipectoral fascia |
| 4 | Deltoideopectoral sulcus | 13 | Pectoralis major muscle (sternocostal part) |
| 5 | Deltoid muscle
(perimysium between bundles of muscle fibers) | 14 | Anterior axillary fold |
| 6 | Skin (cut surface) | 15 | Areola |
| 7 | Clavipectoral triangle
[deltoideopectoral triangle (of MOHRENHEIM)]
after removal of superficial pectoral fascia | 16 | Nipple |
| 8 | Clavicle | 17 | Superficial pectoral fascia (cut edge) |
| 9 | Sternoclavicular joint | 18 | Subcutaneous tissue (cut surface) |
| | | 19 | Superficial pectoral fascia |
| | | 20 | Deep layer of stratum subcutaneum |
| | | 21 | Epimysium of deltoid muscle |

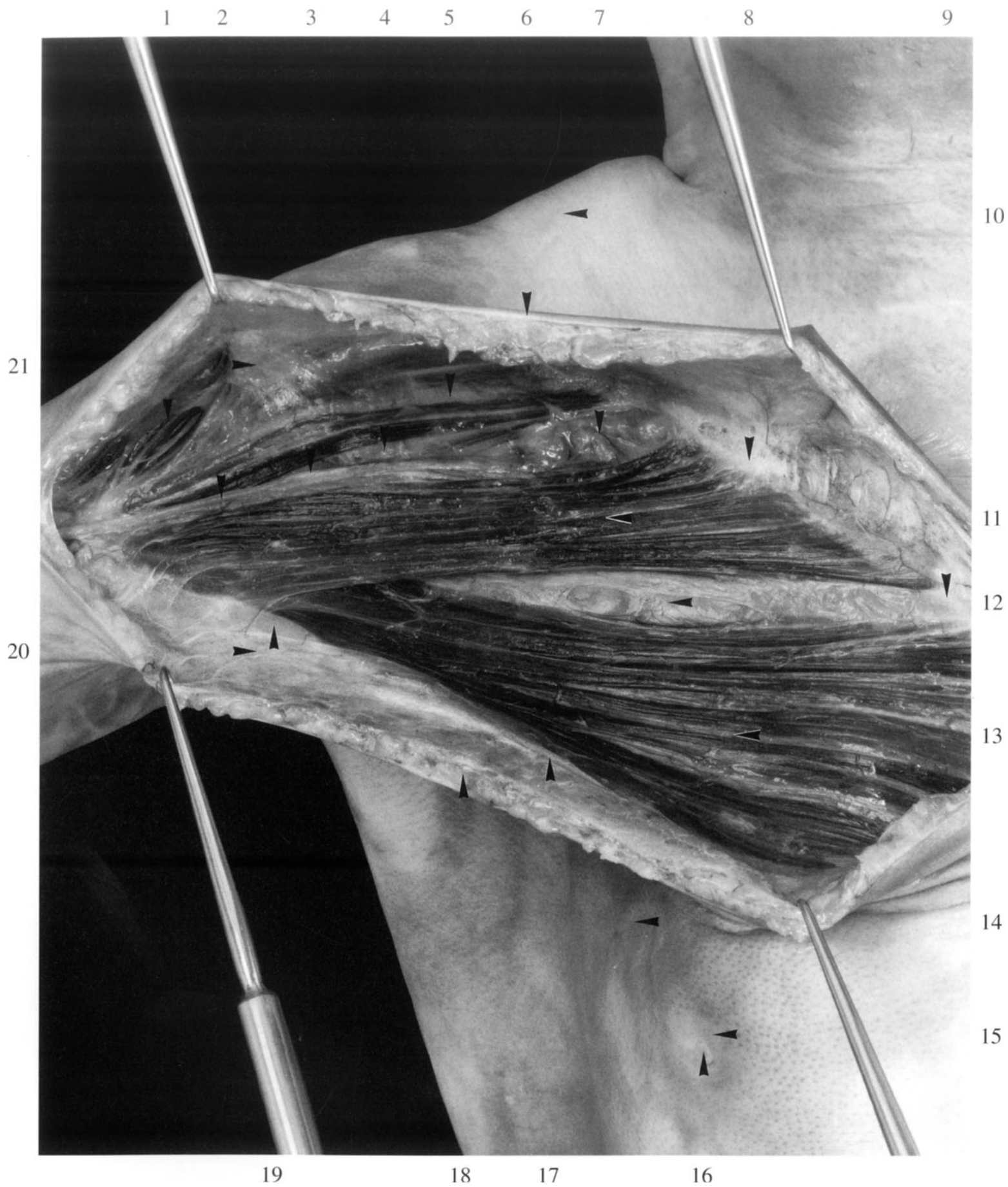


Figure 125

**Infraclavicular Region 3
Clavipectoral Fascia**

- | | | | |
|----|--|----|---|
| 1 | Thoracoacromial artery (deltoid branch) | 12 | Pectoralis major muscle (sternocostal part) |
| 2 | Cephalic vein | 13 | Areola |
| 3 | Deltoid muscle | 14 | Nipple |
| 4 | Subcutaneous tissue (cut surface) | 15 | Anterior axillary fold |
| 5 | Skin (cut surface) | 16 | Posterior axillary fold |
| 6 | Clavipectoral triangle
[deltoideopectoral triangle (of MOHRENHEIM)] | 17 | Deep layer of stratum subcutaneum |
| 7 | Clavicle | 18 | Coracobrachialis muscle |
| 8 | Pectoralis major muscle (clavicular part) | 19 | Pectoralis major muscle (clavicular part) |
| 9 | Lateral pectoral nerve (descending branch
for sternocostal part of pectoralis major muscle) | 20 | Superficial pectoral fascia |
| 10 | Thoracoacromial artery (pectoral branch) | 21 | Pectoralis major muscle (sternocostal part) |
| 11 | Pectoralis minor muscle covered
by anterior layer of clavipectoral fascia | 22 | Thoracoacromial artery (pectoral branch) |
| | | 23 | Clavipectoral fascia |

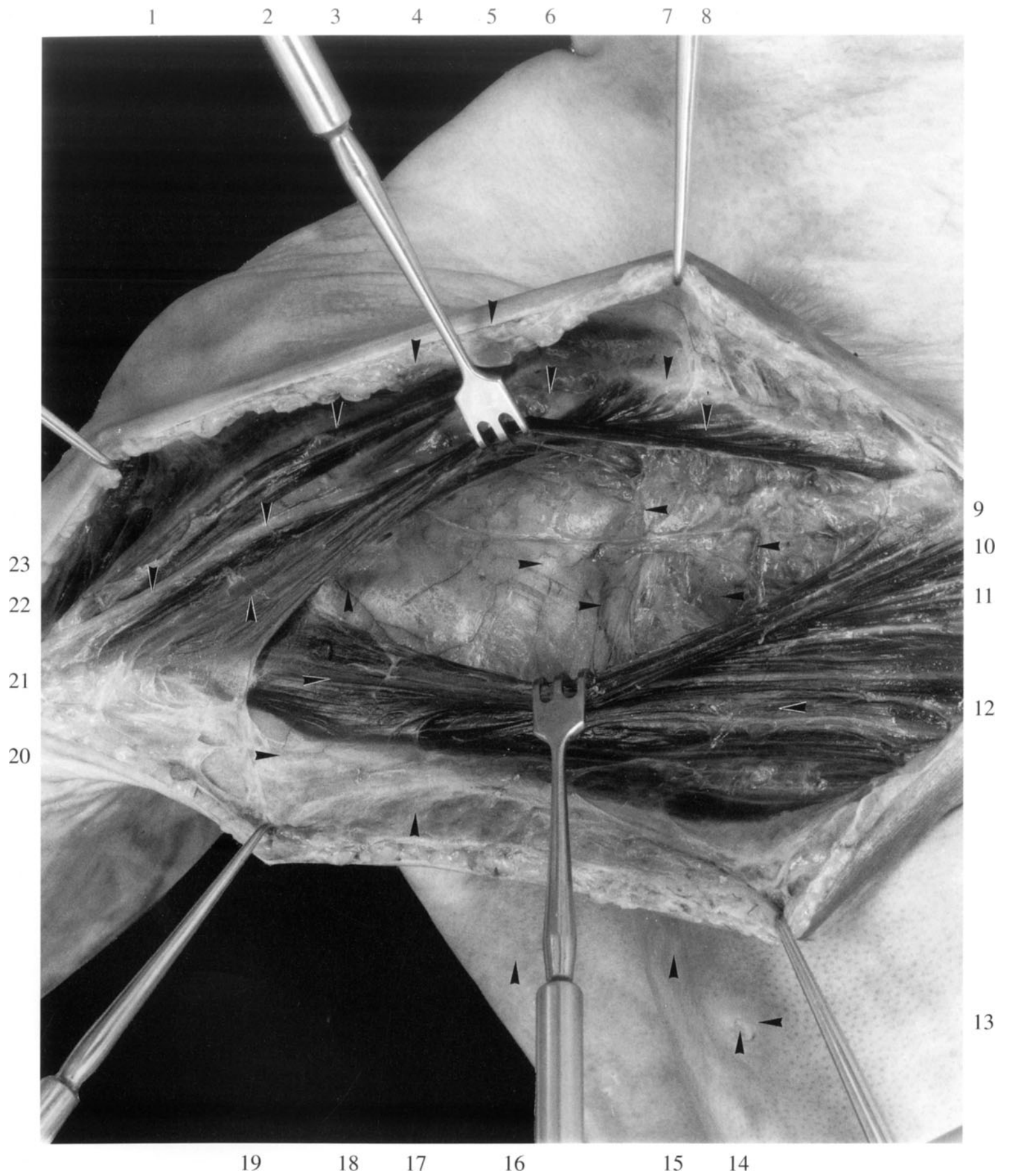


Figure 126**Infraclavicular Region 4
Nerves and Vessels**

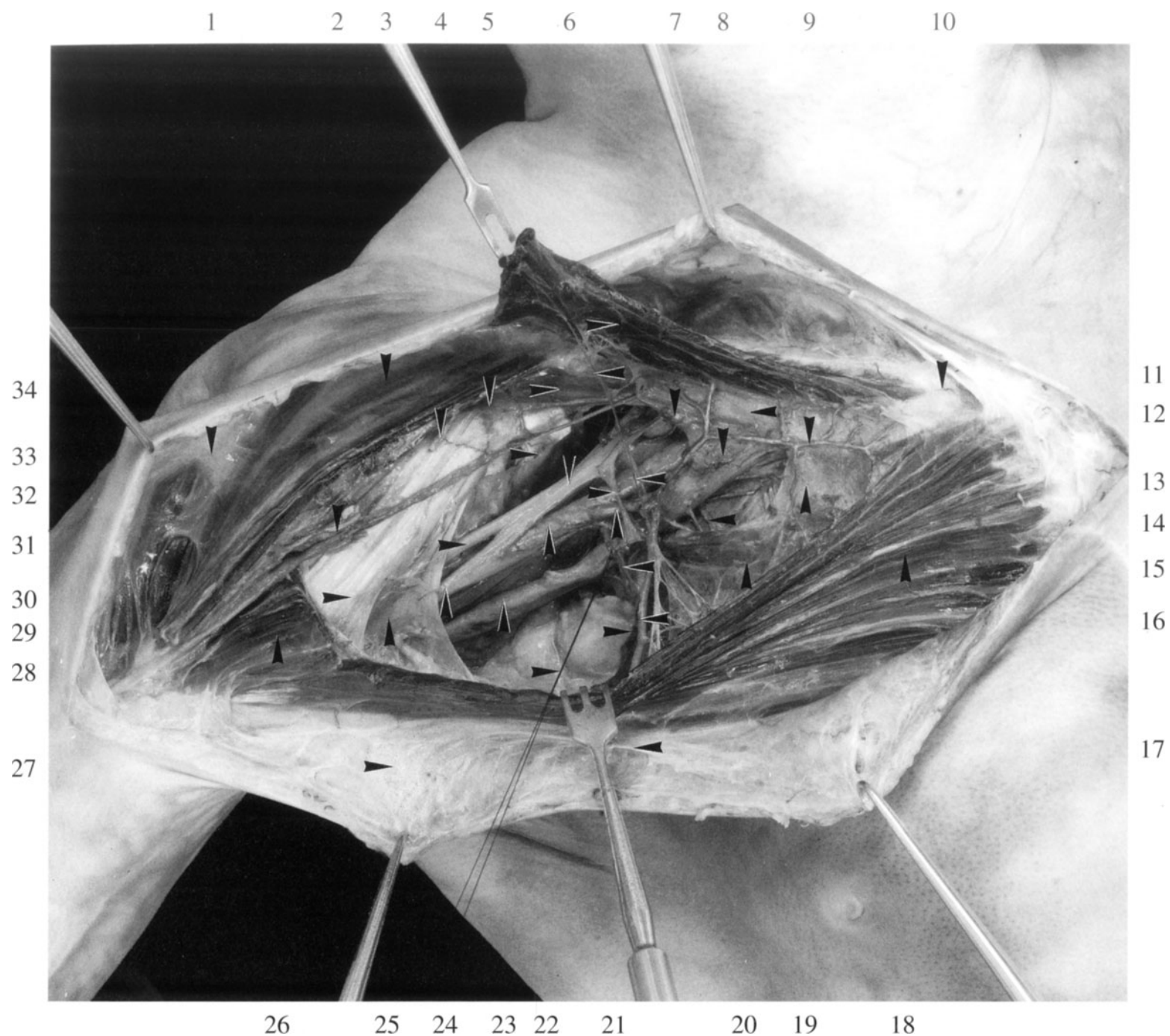
- | | | | |
|----|--|----|---|
| 1 | Pectoralis major muscle (clavicular part) | 19 | Lateral pectoral nerve [anterior pectoral nerve] |
| 2 | Cephalic vein | 20 | First rib |
| 3 | Coracobrachialis muscle (tendon) | 21 | Internal intercostal muscle |
| 4 | Thoracoacromial artery (acromial branch) | | with external intercostal membrane |
| 5 | Thoracoacromial artery (deltoid branch) | 22 | Sternoclavicular joint |
| 6 | Lateral pectoral nerve [anterior pectoral nerve]
(branch for clavicular part
of pectoralis major muscle) | 23 | Subclavius muscle (tendon of origin) |
| 7 | Infraclavicular lymph node | 24 | Thoracoacromial artery (clavicular branch)
and pectoralis major muscle (clavicular part) |
| 8 | Thoracoacromial artery (clavicular branch) | 25 | Axillary vein |
| 9 | Subclavius muscle (tendon of origin) | 26 | Coracoclavicular tract |
| 10 | Sternocleidomastoid muscle
(tendon of sternal head) | 27 | Pectoralis minor muscle
and thoracoacromial artery (deltoid branch) |
| 11 | Deltoideopectoral lymph node | 28 | Coracoid process (tip) |
| 12 | Pectoralis major muscle (clavicular part) | 29 | Pectoralis major muscle (clavicular part) |
| 13 | Lateral pectoral nerve [anterior pectoral nerve]
(branch for sternocostal part
of pectoralis major muscle) | 30 | Cephalic vein |
| 14 | Thoracoacromial artery (pectoral branch) | 31 | Pectoralis major muscle (sternocostal part) |
| 15 | Pectoralis minor muscle
(slip arising from third rib) | 32 | Axillary artery with thoracoacromial artery |
| 16 | Pectoralis major muscle (sternocostal part) | 33 | Medial pectoral nerve [posterior pectoral nerve] |
| 17 | Clavicle | 34 | Thoracoacromial artery (acromial branch) |
| 18 | Subclavius muscle
with infraclavicular lymph node | 35 | Deltoid muscle |
| | | 36 | Posterior axillary fold |
| | | 37 | Anterior axillary fold |
| | | 38 | Pectoralis minor muscle |
| | | 39 | Deltoid muscle |
| | | 40 | Coracoid process (location of tip) |

1 2 3 4 5 6 7 8 9 10



Figure 127**Infraclavicular Region 5
Transition to Axillary Region**

- | | | | |
|----|---|----|--|
| 1 | Epimysium of deltoid muscle | 17 | Superficial pectoral fascia |
| 2 | Cephalic vein and deltoid branch of thoracoacromial artery | 18 | Pectoralis major muscle (sternocostal part) |
| 3 | Deltoid muscle | 19 | Clavipectoral fascia with split cut edge |
| 4 | Thoracoacromial artery (acromial branch) | 20 | Tensor semivaginae muscle of scapulohumeral joint (GRUBER 1860), variant of supernumerary pectoral muscle from second rib to subacromial bursa |
| 5 | Coracoid process (location of tip) | 21 | Thoracoacromial artery |
| 6 | Brachial plexus (lateral cord) | 22 | Axillary artery |
| 7 | Infraclavicular lymph nodes | 23 | Axillary vein |
| 8 | Subclavian vein with fixation and termination of cephalic vein | 24 | Median nerve |
| 9 | Thoracoacromial artery (clavicular branch) | 25 | Clavipectoral fascia (posterior layer) |
| 10 | Sternoclavicular joint | 26 | Pectoralis major muscle (clavicular part) |
| 11 | Lateral pectoral nerve [anterior pectoral nerve] (branch for clavicular part of pectoralis major muscle) | 27 | Deep layer of stratum subcutaneum |
| 12 | Subclavius muscle with fascia | 28 | Axillary fat pad |
| 13 | Lateral pectoral nerve [anterior pectoral nerve] and communicating loop to medial pectoral nerve [posterior pectoral nerve] | 29 | Pectoralis minor muscle (cut edge) |
| 14 | Superior thoracic artery | 30 | Musculocutaneous nerve |
| 15 | Medial pectoral nerve [posterior pectoral nerve] | 31 | Lateral pectoral nerve [anterior pectoral nerve] (separate branch, resected) |
| 16 | Thoracoacromial artery (pectoral branch) | 32 | Pectoralis minor muscle (cut edge) |
| | | 33 | Clavipectoral fascia (remnant with prolongation to subdeltoid space) |
| | | 34 | Pectoralis major muscle (clavicular part) |



- | | | | |
|---|------------------------------------|----|--|
| 1 | Deltoideopectoral sulcus | 8 | Medial bicipital sulcus |
| 2 | Anterior axillary fold | 9 | Skin (dermis) |
| 3 | Skin (cut edge) | 10 | Posterior axillary fold |
| 4 | Biceps brachii muscle | 11 | Medial brachial cutaneous nerve
(medial cutaneous nerve of arm) (side branch) |
| 5 | Deltoid muscle | 12 | Axillary fossa with subcutaneous tissue |
| 6 | Brachial artery (cutaneous branch) | | |
| 7 | Apocrine sweat glands | | |



Figure 129**Axilla 2
Superficial Axillary Fascia**

- | | | | |
|----|---|----|---|
| 1 | Infraclavicular fossa | 21 | Medial brachial cutaneous nerve |
| 2 | Subscapular lymph node | 22 | Intercostobrachial nerve |
| 3 | Brachial lymph node | 23 | Subscapular artery (nodal branch) |
| 4 | Medial brachial cutaneous nerve | 24 | Thoracodorsal artery and vein |
| 5 | Coracobrachialis muscle
with superficial brachial fascia | 25 | Central lymph node |
| 6 | Intercostobrachial nerve | 26 | Fascia of serratus anterior muscle |
| 7 | Fascial brachial arch | 27 | Thoracodorsal artery |
| 8 | Brachial lymph node | 28 | Fascial axillary arch |
| 9 | Latissimus dorsi muscle (tendon)
with superficial fascia | 29 | Subcutaneous tissue |
| 10 | Subcutaneous tissue | 30 | Latissimus dorsi muscle with superficial fascia |
| 11 | Latissimus dorsi muscle
with superficial fascia | 31 | Anastomosis of thoracodorsal artery
with posterior intercostal artery |
| 12 | Brachial lymph node (deep) | 32 | Intercostobrachial nerve (T2)
with anastomosis of medial cutaneous nerve |
| 13 | Deep axillary fascia | 33 | Intercostobrachial nerve (T3) |
| 14 | Central lymph node | 34 | Serratus anterior muscle |
| 15 | Central lymph node | 35 | Central lymph node |
| 16 | Fascial brachial arch | 36 | Axillary cribriform plate (of EISLER) |
| 17 | Brachial lymph node | 37 | Superficial axillary fascia |
| 18 | Subscapular lymph node | 38 | Subcutaneous tissue of axillary fossa |
| 19 | Axillary cribriform plate (of EISLER) | 39 | Fascial axillary arch |
| 20 | Coracobrachialis muscle | 40 | Pectoralis major muscle
with superficial pectoral fascia |

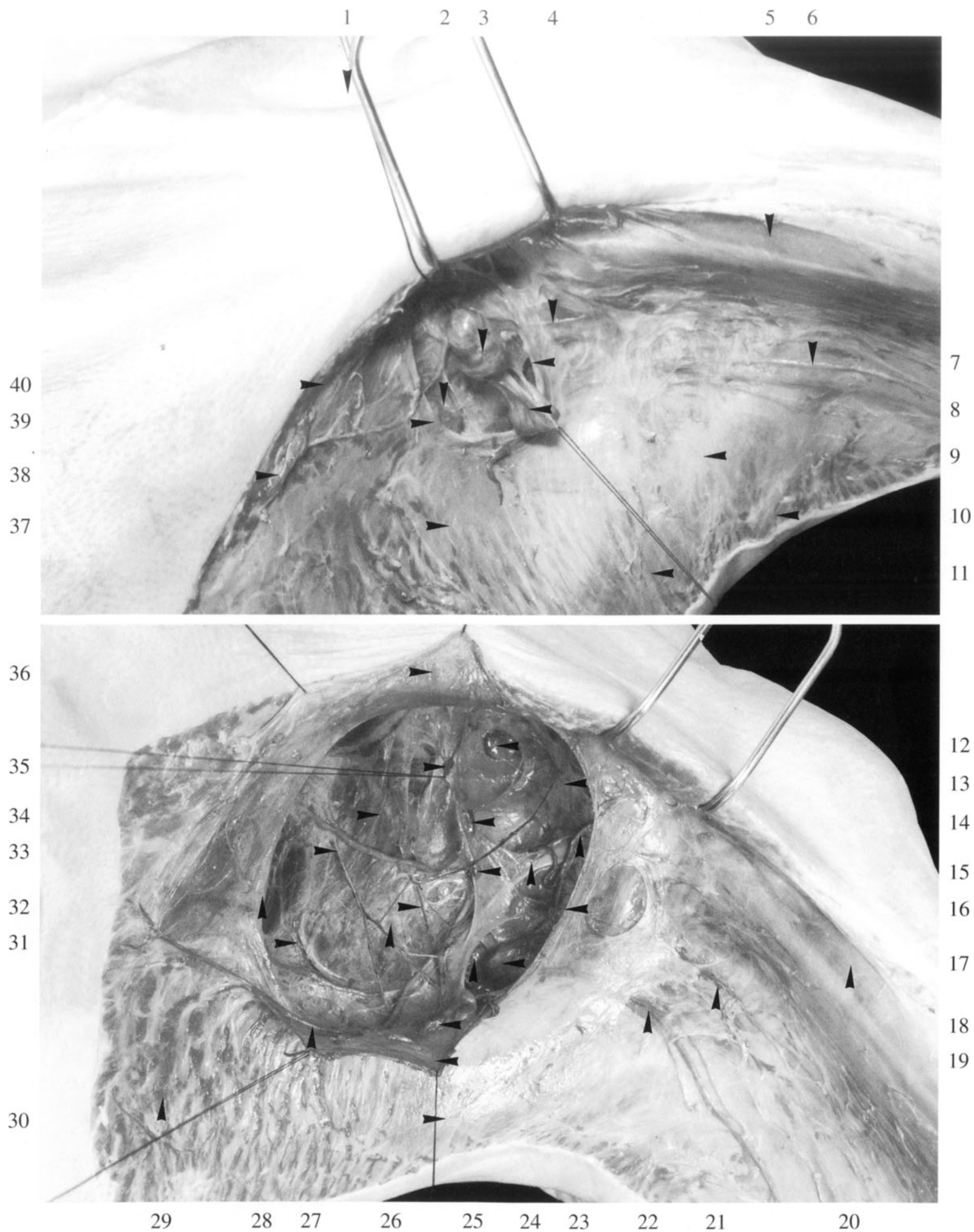


Figure 130

**Axilla 3
Axillary Space 1**

- | | | | |
|----|--|----|---|
| 1 | Deltoid muscle | 16 | Third intercostal nerve |
| 2 | Deep axillary fascia | | (lateral cutaneous branch) |
| 3 | Fascial brachial arch | 17 | Posterior intercostal artery |
| 4 | Biceps brachii muscle (short head) | | (lateral cutaneous branch) |
| | with superficial brachial fascia | 18 | Intercostobrachial nerve |
| 5 | Superficial brachial fascia | 19 | Superficial axillary fascia |
| 6 | Latissimus dorsi muscle (tendon) | 20 | Fascial axillary arch |
| | with superficial fascia | 21 | Lateral thoracic artery |
| 7 | Cutaneous branch | 22 | Lateral thoracic artery |
| | of superior ulnar collateral artery | 23 | Lateral thoracic artery |
| 8 | Medial brachial cutaneous nerve | 24 | Subscapular lymph nodes in axillary fat pad |
| 9 | Brachial artery (cutaneous branch) | 25 | Axillary fat pad |
| 10 | Costoaxillary vein (of BRAUNE) | 26 | Pectoralis major muscle |
| 11 | Brachial lymph node | | with superficial pectoral fascia |
| 12 | Posterior axillary fold | 27 | Brachial lymph node |
| 13 | Retinacula cutis (numerous and lamellated) | 28 | Brachial lymph node |
| 14 | Posterior intercostal artery | 29 | Subcutaneous tissue of anterior axillary fold |
| | (lateral cutaneous branch) | 30 | Brachial artery (cutaneous branch) |
| 15 | Posterior intercostal artery | 31 | Brachial artery (cutaneous branch) |
| | (lateral cutaneous branch) | | |

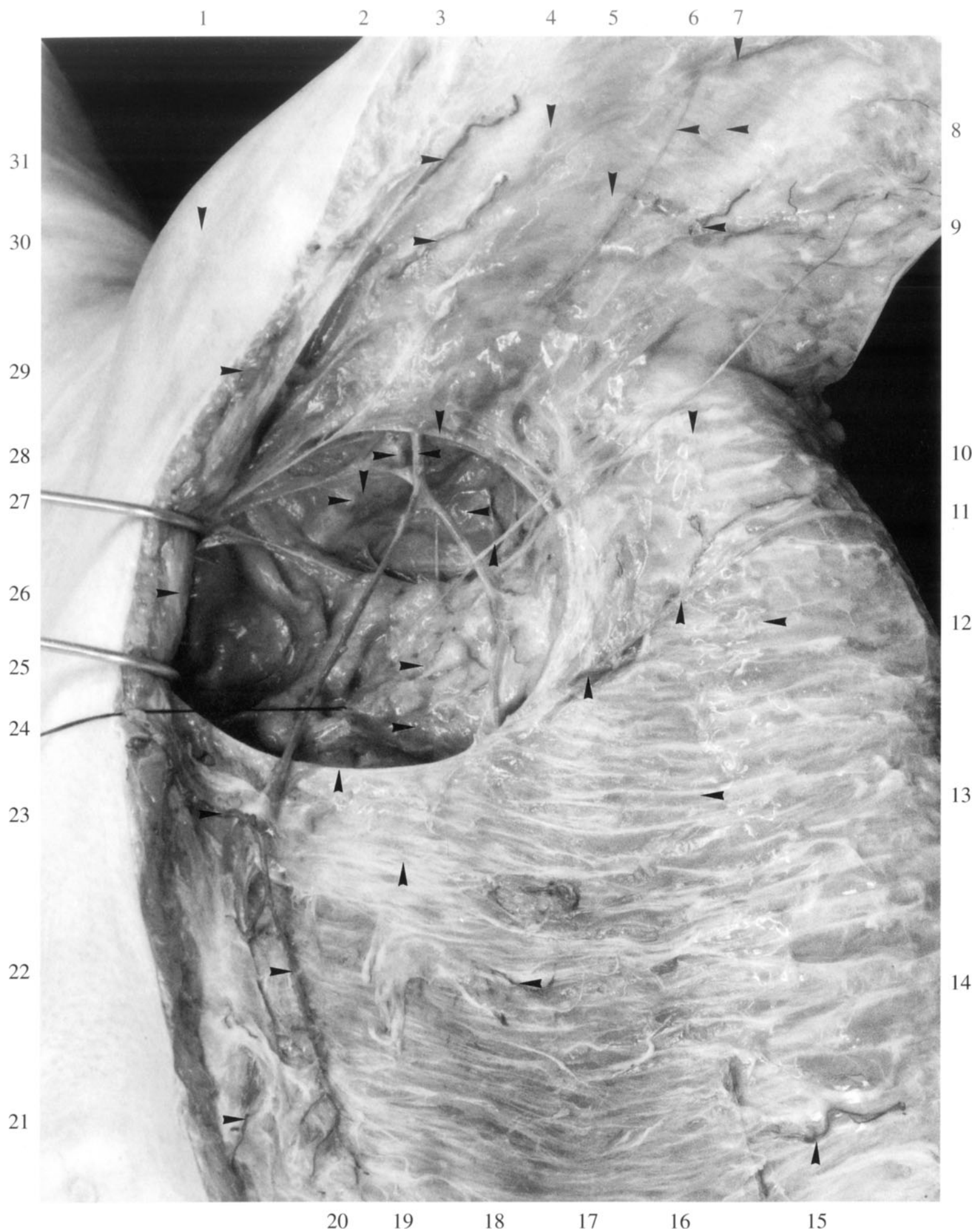


Figure 131**Axilla 4
Axillary Space 2
Axillary Lymph Nodes**

- | | |
|---|---|
| 1 Deltoid muscle (clavicular part) | 16 Posterior axillary fold |
| 2 Deep axillary fascia on neurovascular bundle | 17 Third intercostal nerve |
| 3 Deep axillary fascia anterior | (lateral cutaneous branch) |
| to subscapularis muscle | and posterior intercostal artery |
| 4 Fascial brachial arch | (lateral cutaneous branch) |
| 5 Biceps brachii muscle (short head) | 18 Subscapular lymph node |
| with superficial brachial fascia | 19 Axillary fat pad (remnant with blood vessels |
| 6 Brachial artery (cutaneous branch) | for fatty tissue and lymph nodes) |
| 7 Profunda brachii artery (cutaneous branch) | 20 Fascial axillary arch |
| 8 Brachial lymph nodes | 21 Lateral thoracic artery |
| 9 Subscapular artery (branch to lymph nodes) | 22 Lateral thoracic artery |
| 10 Intercostobrachial nerve | 23 Pectoral lymph node (of SORGIUS) |
| 11 Central lymph node | 24 Lateral thoracic artery |
| 12 Central lymph node | 25 Pectoral lymph nodes |
| 13 Serratus anterior muscle (slip from third rib) | 26 Brachial lymph node (deep) |
| 14 Posterior intercostal artery | 27 Subscapular nerve |
| (lateral cutaneous branch) | 28 Costoaxillary vein (of BRAUNE) |
| 15 Posterior intercostal artery | 29 Pectoralis major muscle |
| (lateral cutaneous branch) | 30 Brachial artery (cutaneous branch) |
| | 31 Brachial artery (cutaneous branch) |

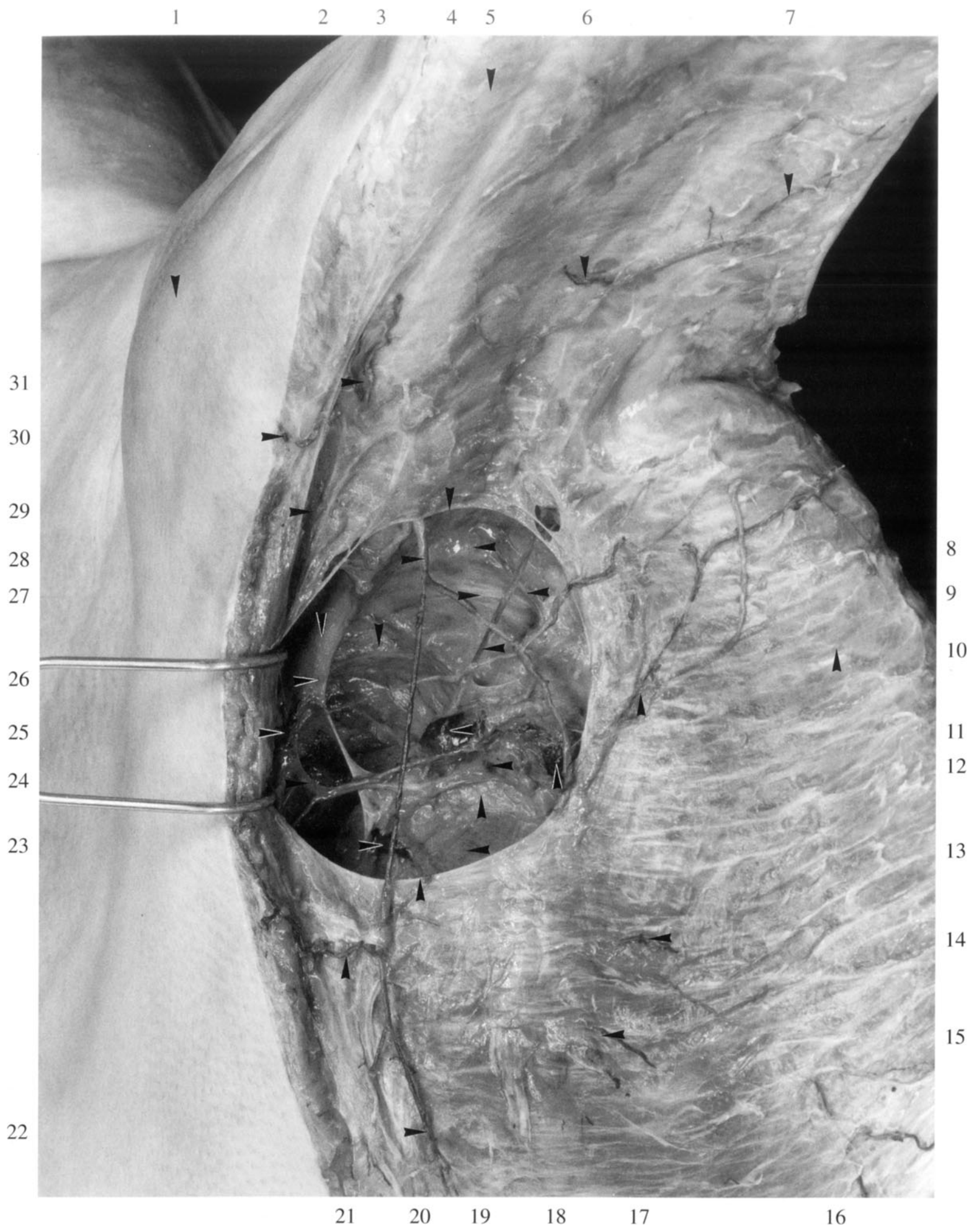


Figure 132**Axilla 5
Axillary Space 3
Fasciae**

- | | | | |
|----|--|----|---|
| 1 | Deep axillary fascia | 16 | Thoracodorsal nerve to latissimus dorsi muscle |
| 2 | Fascial brachial arch | 17 | Fascial axillary arch |
| 3 | Medial brachial cutaneous nerve | 18 | Lateral thoracic artery |
| 4 | Triceps brachii muscle (long head)
with superficial brachial fascia | 19 | Lateral thoracic artery |
| 5 | Brachial artery (cutaneous branch) | 20 | Anastomosis of lateral thoracic artery
with posterior intercostal artery |
| 6 | Profunda brachii artery (cutaneous branch) | 21 | Intercostobrachial nerve |
| 7 | Intercostobrachial nerve
covered by superficial brachial fascia | 22 | Apical lymph node |
| 8 | Costoaxillary vein (of BRAUNE) | 23 | Apical lymph node |
| 9 | Subscapular lymph node | 24 | Subscapularis muscle with deep axillary fascia |
| 10 | Third posterior intercostal artery
(lateral cutaneous branch) | 25 | Brachial lymph node |
| 11 | Serratus anterior muscle with fascia | 26 | Brachial lymph node |
| 12 | Superficial axillary fascia | 27 | Pectoralis major muscle |
| 13 | Posterior axillary fold | 28 | Superficial pectoral fascia |
| 14 | Third intercostal nerve
(lateral cutaneous branch) | 29 | Brachial artery (cutaneous branch) |
| 15 | Subscapular nerve to teres major muscle | 30 | Superficial brachial fascia |
| | | 31 | Biceps brachii muscle (short head)
with superficial brachial fascia |



Figure 133**Axilla 6
Axillary Space 4
Arteries and Nerves**

- | | | | |
|----|---|----|---|
| 1 | Anastomosis
with second posterior intercostal artery | 20 | Circumflex scapular artery |
| 2 | Intercostobrachial nerve from T3 | 21 | Latissimus dorsi muscle (tendon) |
| 3 | Intercostobrachial nerve from T2 | 22 | Teres major muscle |
| 4 | Subscapular artery | 23 | Intercostobrachial nerve |
| 5 | Medial brachial cutaneous nerve | 24 | Subscapular nerve
(branch for teres major muscle) |
| 6 | Posterior cord of brachial plexus | 25 | Thoracodorsal nerve |
| 7 | Medial cord of brachial plexus | 26 | Subscapularis muscle with subscapular fascia |
| 8 | Medial root of median nerve | 27 | Subscapularis muscle with subscapular fascia |
| 9 | Radial nerve | 28 | Serratus anterior muscle with fascia |
| 10 | Medial brachial cutaneous nerve | 29 | Thoracodorsal artery |
| 11 | Superficial axillary fascia (cut edge) | 30 | Long thoracic nerve |
| 12 | Median nerve | 31 | Anastomosis of intercostobrachial nerve |
| 13 | Medial brachial cutaneous nerve | 32 | Subscapular nerve
(branch for subscapularis muscle) |
| 14 | Coracobrachialis muscle
with superficial brachial fascia | 33 | Superficial thoracic artery (of MANCHOT)
(lateral version) |
| 15 | Anterior circumflex humeral artery | 34 | Subscapular nerve |
| 16 | Lateral root of median nerve | 35 | Axillary artery |
| 17 | Posterior circumflex humeral artery | 36 | Clavipectoral fascia |
| 18 | Axillary nerve | | |
| 19 | Triceps brachii muscle (tendon of long head) | | |

1 2 3 4 5 6 7 8 9 10 11 12 13 14

36

35

34

33

32

31

30

29

15

16

17

18

19

20

21

22



28

27

26

25

24

23

- | | |
|--|--|
| 1 Brachial artery | 20 Lateral cutaneous branch |
| 2 Medial brachial cutaneous nerve | of second intercostal nerve |
| 3 Median nerve | 21 Subscapular vein (termination) |
| 4 Coracobrachialis muscle | 22 Circumflex scapular artery |
| 5 Medial antebrachial cutaneous nerve | covered by deep axillary fascia |
| (medial cutaneous nerve of forearm) | 23 Fat of quadrangular and triangular spaces |
| 6 Axillary nerve | covered by deep axillary fascia |
| 7 Deltoid muscle | 24 Latissimus dorsi muscle |
| 8 Lateral pectoral nerve [anterior pectoral nerve] | 25 Long thoracic nerve |
| 9 Thoracoacromial artery and vein | 26 Lateral cutaneous branch |
| (deltoid branches) | of second intercostal nerve |
| 10 Thoracoacromial vein (deltoid branch) | 27 Subscapularis muscle |
| 11 Pectoralis major muscle (tendon of insertion) | covered by deep axillary fascia |
| 12 Pectoralis minor muscle in clavipectoral fascia | 28 Teres major muscle |
| 13 Axillary vein | covered by deep axillary fascia |
| 14 Clavipectoral fascia | 29 Circumflex scapular vein |
| 15 Subscapular nerve | covered by deep axillary fascia |
| covered by deep axillary fascia | 30 Latissimus dorsi muscle (tendon of insertion) |
| 16 Thoracodorsal nerve | 31 Posterior circumflex humeral vein |
| covered by deep axillary fascia | covered by deep axillary fascia |
| 17 Thoracodorsal artery | 32 Medial antebrachial cutaneous nerve |
| covered by deep axillary fascia | (brachial cutaneous branch) |
| 18 Lateral thoracic artery | 33 Brachial artery (muscular branch) |
| 19 Serratus anterior muscle with fascia | 34 Biceps brachii muscle (short head) |

1 2 3 4 5 6 7 8 9 10

34

11

33

32

31

30

29

28

27

26

25

12

13

14

15

16

17

18

19

24

23

22

21

20

Figure 135

Axilla 8
Axillary Fat Pad
Cutaneous Arteries

- | | |
|---|---|
| 1 Biceps brachii muscle
(short head with superficial brachial fascia) | 18 Serratus anterior muscle
(slip from fourth rib,
with serratus anterior fascia) |
| 2 Brachial artery (cutaneous branch) | 19 Fourth posterior intercostal artery
and fourth intercostal nerve
(lateral cutaneous branches) |
| 3 Neurovascular bundle with deep axillary fascia | 20 Latissimus dorsi muscle |
| 4 Brachial lymph node | 21 Costoaxillary vein (of BRAUNE) |
| 5 Deltoid muscle | 22 Superficial thoracic artery (of MANCHOT)
(lateral version) |
| 6 Pectoralis major muscle (sternocostal part) | 23 Third posterior intercostal artery
and third intercostal nerve
(lateral cutaneous branches) |
| 7 Pectoralis major muscle (clavicular part) | 24 Subscapular lymph node |
| 8 Greater supraclavicular fossa | 25 Superficial thoracic artery (of MANCHOT),
dorsal cutaneous branch with a dorsal twig
from the lateral cutaneous branch
of the third intercostal nerve |
| 9 Trapezius muscle | 26 Costoaxillary vein (of BRAUNE) |
| 10 Thoracoacromial artery
(cutaneous branch of deltoid branch) | 27 Intercostobrachial nerve |
| 11 Clavipectoral triangle | 28 Latissimus dorsi muscle (tendon of insertion) |
| 12 Sternoclavicular joint | 29 Medial bicipital sulcus |
| 13 Serratus anterior muscle
(slip from third rib, with serratus anterior fascia) | |
| 14 Internal thoracic artery
(second perforating branch) | |
| 15 Internal thoracic artery
(third perforating branch) | |
| 16 Internal thoracic artery
(sixth perforating branch) | |
| 17 Sternal membrane | |



Figure 136

Axilla 9
Axillary Lymph Nodes

- | | | | |
|----|--|----|---|
| 1 | Medial bicipital sulcus | 18 | Sternal membrane |
| 2 | Biceps brachii muscle (short head)
with superficial brachial fascia | 19 | Pectoralis major muscle (sternocostal part) |
| 3 | Intercostobrachial nerve | 20 | Serratus anterior muscle (slip from fifth rib)
with serratus anterior fascia |
| 4 | Brachial lymph node | 21 | Fourth intercostal nerve
(lateral cutaneous branch) |
| 5 | Brachial lymph node | 22 | Third intercostal nerve
(lateral cutaneous branch) |
| 6 | Pectoral lymph node | 23 | Latissimus dorsi muscle |
| 7 | Subpectoral lymph node | 24 | Costoaxillary vein (of BRAUNE) |
| 8 | Interpectoral lymph nodes | 25 | Superficial thoracic artery (of MANCHOT) |
| 9 | Trapezius muscle | 26 | Serratus anterior muscle (slip from third rib)
with serratus anterior fascia |
| 10 | Greater supraclavicular fossa | 27 | Subscapular lymph node |
| 11 | Sternoclavicular joint | 28 | Subscapular lymph node |
| 12 | Pectoralis major muscle (clavicular part) | 29 | Central lymph node |
| 13 | Central lymph node | 30 | Latissimus dorsi muscle (tendon of insertion) |
| 14 | Pectoral lymph node | | |
| 15 | Pectoral lymph node (of SORGIUS) | | |
| 16 | Lateral thoracic artery | | |
| 17 | Paramammary node (of GEROTA) | | |

1 2 3 4 5 6 7 8 9 10 11

30
29
28
27
26
25
24
23

12
13
14
15
16
17

22 21 20 19 18



- | | |
|--|--|
| 1 Medial bicipital sulcus | 20 Sternal membrane |
| 2 Biceps brachii muscle (short head)
with superficial brachial fascia | 21 Internal thoracic artery
(third perforating branch) |
| 3 Coracobrachialis muscle
with superficial brachial fascia | 22 Pectoralis major muscle (sternocostal part) |
| 4 Latissimus dorsi muscle (tendon of insertion) | 23 Paramammary node (of GEROTA) |
| 5 Medial brachial cutaneous nerve | 24 Superficial thoracic artery (of MANCHOT)
(mammary branch) |
| 6 Neurovascular bundle with deep axillary fascia | 25 Superficial thoracic artery (of MANCHOT)
(anastomosis with fourth posterior
intercostal artery) |
| 7 Superficial thoracic artery (of MANCHOT)
(lateral version) | 26 Third posterior intercostal artery
(lateral cutaneous branch) |
| 8 Intercostobrachial nerve | 27 Third intercostal nerve
(lateral cutaneous branch) |
| 9 Pectoralis minor muscle | 28 Thoracoepigastric vein |
| 10 Pectoralis major muscle (clavicular part) | 29 Serratus anterior muscle (slip from third rib) |
| 11 Sternoclavicular joint | 30 Subscapular lymph node |
| 12 Deltoid muscle | 31 Subscapular lymph node |
| 13 Clavipectoral triangle | 32 Long thoracic nerve |
| 14 Subscapularis muscle | 33 Costoaxillary vein (of BRAUNE) |
| 15 Subpectoral lymph node | 34 Axillary vein |
| 16 Second rib | 35 Brachial artery (cutaneous branch) |
| 17 Intercostalis externus muscle | |
| 18 Third rib | |
| 19 Lateral thoracic artery | |

1 2 3 4 5 6 7 8 9 10 11

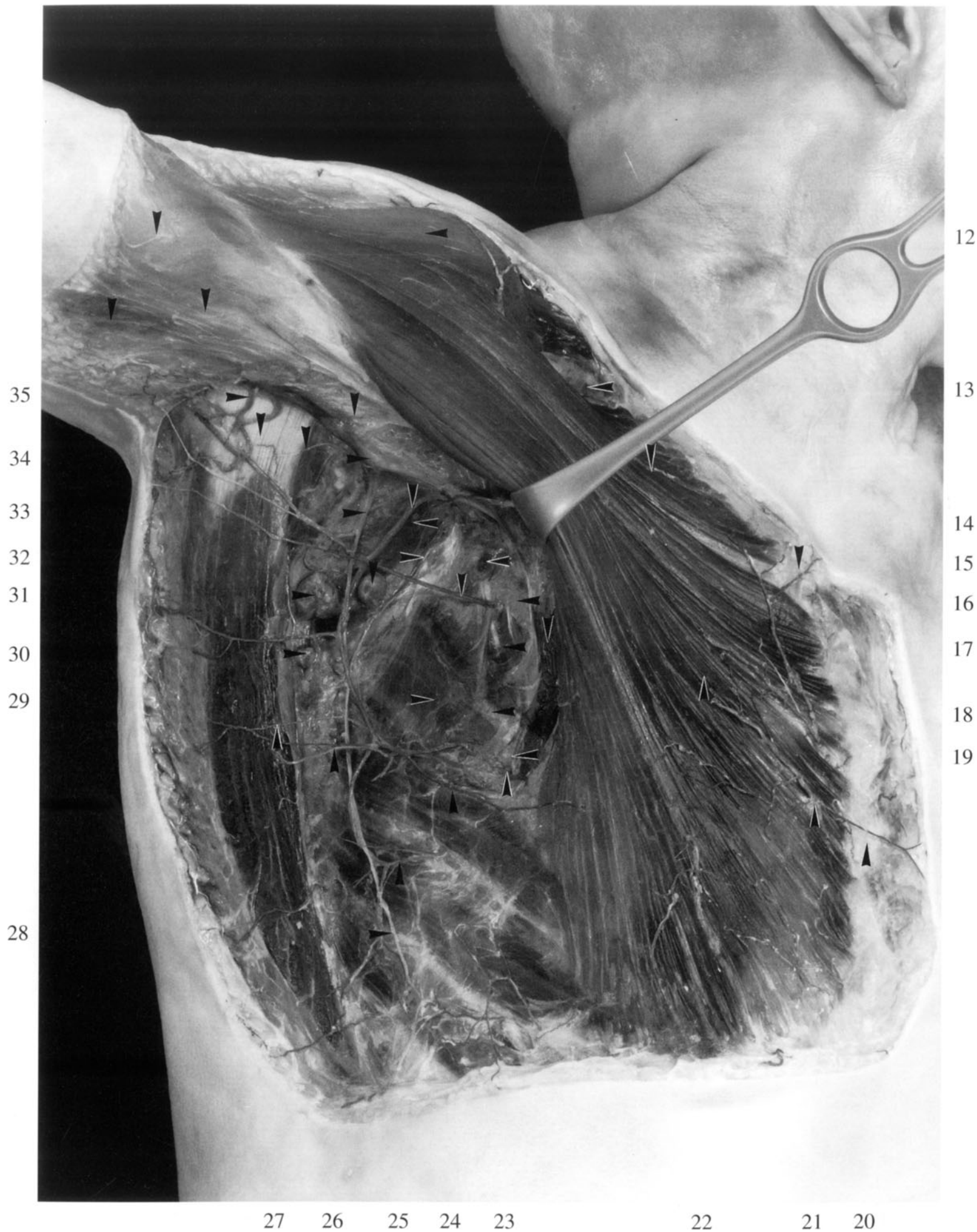


Figure 138

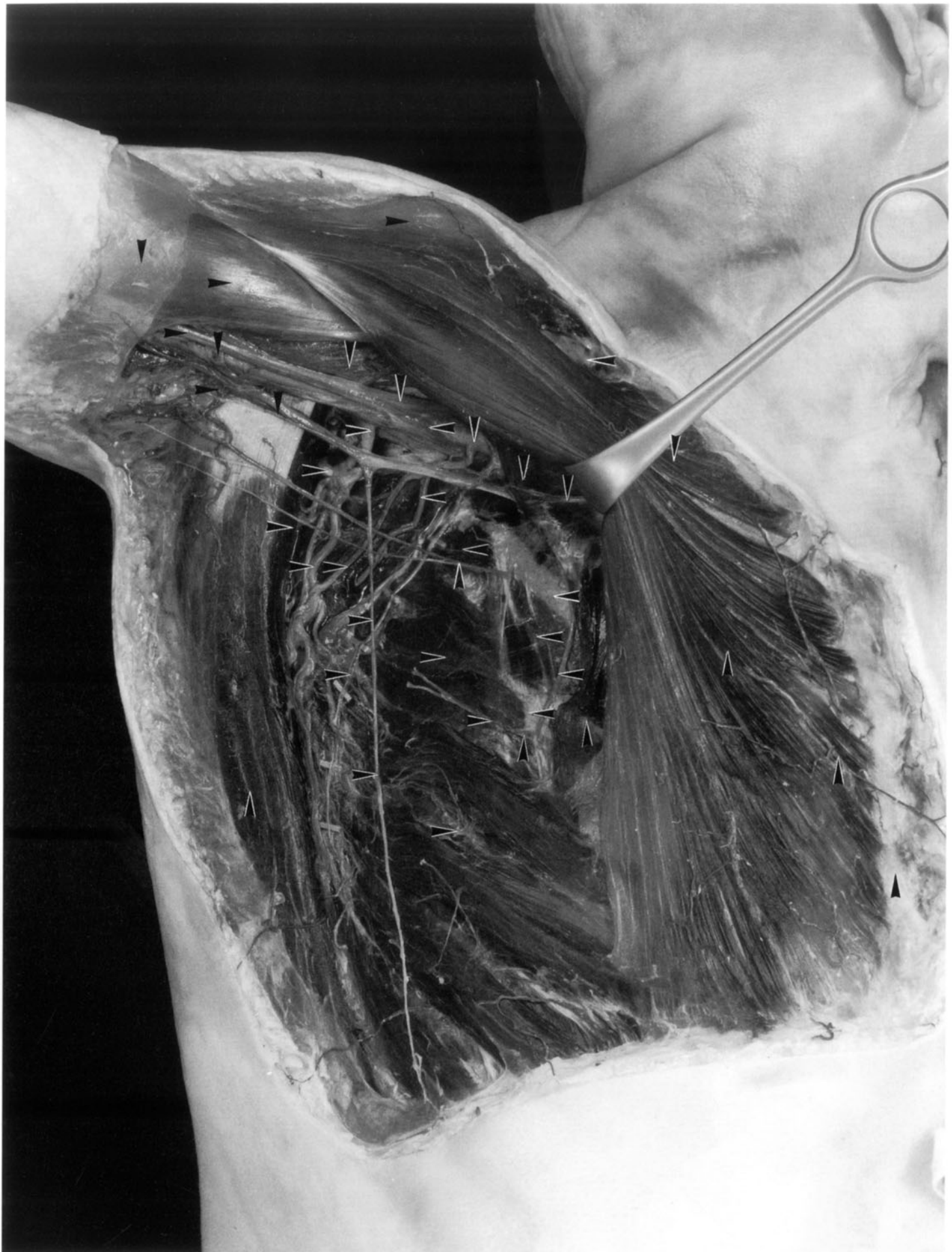
Axilla 11
Vessels and Nerves

- | | | | |
|----|--|----|---|
| 1 | Superficial brachial fascia | 22 | Anastomosis of lateral thoracic artery with third posterior intercostal artery |
| 2 | Lateral brachial vein | 23 | Intercostobrachial nerve |
| 3 | Medial brachial cutaneous nerve and axillary vein | 24 | Latissimus dorsi muscle |
| 4 | Coracobrachialis muscle | 25 | Fourth intercostal nerve and fourth posterior intercostal artery (lateral cutaneous branch) |
| 5 | Median nerve (lateral root) | 26 | Thoracoepigastric vein |
| 6 | Axillary artery | 27 | Third intercostal nerve and third posterior intercostal artery (lateral cutaneous branch) |
| 7 | Pectoralis minor muscle | 28 | Long thoracic nerve |
| 8 | Medial pectoral nerve [posterior pectoral nerve] | 29 | Anterior serratus muscle (slip from third rib) |
| 9 | Pectoralis major muscle (clavicular part) | 30 | Costoaxillary vein (of BRAUNE) |
| 10 | Clavipectoral triangle | 31 | Thoracodorsal artery and nerve |
| 11 | Median nerve (medial root) | 32 | Teres major muscle |
| 12 | Superficial thoracic artery (of MANCHOT) (lateral version) | 33 | Circumflex scapular artery |
| 13 | Serratus anterior muscle | 34 | Subscapular artery |
| 14 | Second rib | 35 | Brachial artery (cutaneous branch) |
| 15 | Intercostalis externus muscle | 36 | Median nerve |
| 16 | Lateral thoracic artery | 37 | Biceps brachii muscle (short head) |
| 17 | Third rib | 38 | Deltoid muscle |
| 18 | Sternal membrane | | |
| 19 | Internal thoracic artery (third perforating branch) | | |
| 20 | Pectoralis major muscle (sternocostal part) | | |
| 21 | Pectoralis minor muscle | | |

1 2 3 4 5 6 7 8 9

38
37
36
35
34
33
32
31
30
29
28
27
26
25

10
11
12
13
14
15
16
17



24 23 22 21 20 19 18

Figure 139

Axilla 12
Axillary Artery
Brachial Plexus

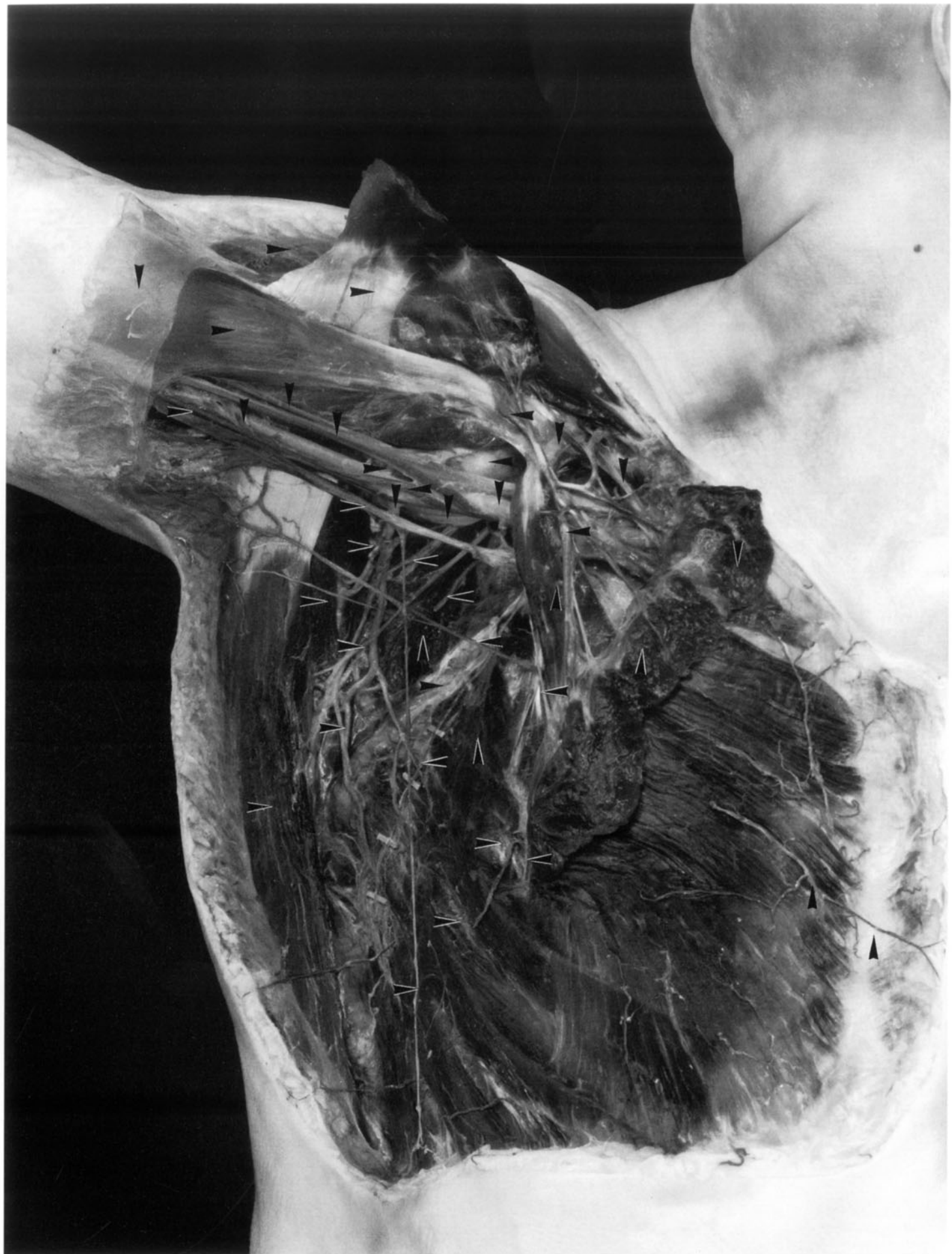
- | | | | |
|----|---|----|---|
| 1 | Superficial brachial fascia | 22 | Internal thoracic artery
(third perforating branch) |
| 2 | Lateral brachial vein
(termination at axillary vein) | 23 | Pectoralis major muscle
(sternocostal part, cut surface) |
| 3 | Musculocutaneous nerve | 24 | Pectoralis minor muscle |
| 4 | Median nerve | 25 | Serratus anterior muscle (slip from third rib) |
| 5 | Subscapular artery | 26 | Subscapularis muscle |
| 6 | Axillary nerve | 27 | Thoracoepigastric vein |
| 7 | Axillary artery
with union of median nerve roots | 28 | Fourth posterior intercostal artery
(lateral cutaneous branch) |
| 8 | Coracoid process | 29 | Third posterior intercostal artery
(lateral cutaneous branch) |
| 9 | Coracoclavicular tract | 30 | Latissimus dorsi muscle |
| 10 | Pectoralis major muscle
(clavicular part, cut surface) | 31 | Thoracodorsal artery and vein |
| 11 | Thoracoacromial artery (deltoid branch) | 32 | Thoracodorsal nerve |
| 12 | Subscapularis muscle (tendon of insertion) | 33 | Teres major muscle |
| 13 | Ulnar nerve | 34 | Circumflex scapular artery |
| 14 | Thoracoacromial artery (pectoral branches) | 35 | Axillary vein |
| 15 | Subscapular nerve | 36 | Posterior circumflex humeral artery |
| 16 | Superficial thoracic artery (of MANCHOT)
(lateral version, resected) | 37 | Medial antebrachial cutaneous nerve |
| 17 | Intercostobrachial nerve | 38 | Biceps brachii muscle (short head) |
| 18 | Medial pectoral nerve
[posterior pectoral nerve] | 39 | Pectoralis major muscle
(tendinous insertion
of sternocostal part and abdominal part) |
| 19 | Long thoracic nerve | 40 | Deltoid muscle |
| 20 | Lateral thoracic artery | | |
| 21 | Sternal membrane | | |

1 2 3 4 5 6 7 8 9 10

40
39
38
37
36
35
34
33
32
31
30
29
28
27

11
12
13
14
15
16
17
18
19
20

26 25 24 23 22 21



- | | | | |
|----|--|----|--|
| 1 | Musculocutaneous nerve | 23 | Thoracodorsal vein |
| 2 | Superior ulnar collateral artery | 24 | Thoracodorsal artery |
| 3 | Medial antebrachial cutaneous nerve
(brachial cutaneous branch) | 25 | Lateral thoracic artery |
| 4 | Coracobrachialis muscle | 26 | Lateral chest wall with serratus anterior muscle |
| 5 | Radial nerve | 27 | Third intercostal nerve
(lateral cutaneous branch) |
| 6 | Median nerve | 28 | Subscapularis muscle with deep axillary fascia |
| 7 | Medial antebrachial cutaneous nerve | 29 | Ulnar nerve |
| 8 | Subscapularis muscle (tendon of insertion) | 30 | Latissimus dorsi muscle |
| 9 | Axillary nerve | 31 | Medial brachial cutaneous nerve
replacing intercostobrachial nerve |
| 10 | Musculocutaneous nerve | 32 | Radial nerve (muscular branch) |
| 11 | Axillary artery between median nerve roots | 33 | Triceps brachii muscle (long head) |
| 12 | Pectoralis minor muscle | 34 | Ulnar nerve |
| 13 | Deltoid muscle | 35 | Teres major muscle |
| 14 | Coracoid process (genu) | 36 | Circumflex scapular vein |
| 15 | Shoulder joint (articular capsule) | 37 | Brachial artery (muscular branch) |
| 16 | Anterior circumflex humeral artery | 38 | Brachial artery |
| 17 | Lateral cord of brachial plexus | 39 | Brachial artery (muscular branch)
[superior radial collateral artery] |
| 18 | Medial cord of brachial plexus | 40 | Biceps brachii muscle (short head) |
| 19 | Subscapular artery | 41 | Pectoralis major muscle
(tendon of insertion, resected) |
| 20 | Subscapular nerve | | |
| 21 | Long thoracic nerve | | |
| 22 | Thoracodorsal nerve | | |



Figure 141**Arm and Axilla 2
Entrance to Posterior Compartment**

- | | |
|--|---|
| 1 Median nerve | 24 Thoracodorsal artery |
| 2 Triceps brachii muscle (medial head) | (covered by deep axillary fascia) |
| 3 Middle collateral artery | 25 Lateral thoracic nerve |
| 4 Musculocutaneous nerve | 26 Lateral thoracic artery |
| 5 Radial collateral artery | 27 Serratus anterior muscle |
| 6 Profunda brachii artery | (covered by fascia of serratus anterior muscle) |
| 7 Radial nerve | 28 Intercostobrachial nerve |
| 8 Axillary artery at junction with brachial artery | 29 Third intercostal nerve |
| 9 Medial antebrachial cutaneous nerve | (lateral cutaneous branch) |
| 10 Median nerve | 30 Ulnar nerve |
| 11 Radial nerve | 31 Brachial vein |
| 12 Subscapular artery (circumflex scapular branch) | and medial brachial cutaneous nerve |
| 13 Axillary vein | 32 Ulnar nerve |
| 14 Intercostobrachial nerve | 33 Medial brachial cutaneous nerve |
| 15 Deltoid muscle | 34 Triceps brachii muscle (long head) |
| 16 Clavipectoral triangle | 35 Latissimus dorsi muscle |
| 17 Pectoralis major muscle | 36 Thoracodorsal vein |
| 18 Coracobrachialis muscle | (covered by deep axillary fascia) |
| 19 Anterior circumflex humeral artery | 37 Posterior brachial cutaneous nerve |
| 20 Anastomosis of intercostobrachial nerve | 38 Termination of lateral brachial vein |
| with medial brachial cutaneous nerve | in medial brachial vein |
| 21 Circumflex scapular vein | 39 Brachial artery with lateral brachial vein |
| 22 Subscapularis muscle with deep axillary fascia | 40 Profunda brachii artery |
| 23 Thoracodorsal nerve | (deltoid branch [ascending branch]) |
| (covered by deep axillary fascia) | 41 Biceps brachii muscle (short head) |

1 2 3 4 5 6 7 8 9 10 11 12 13 14

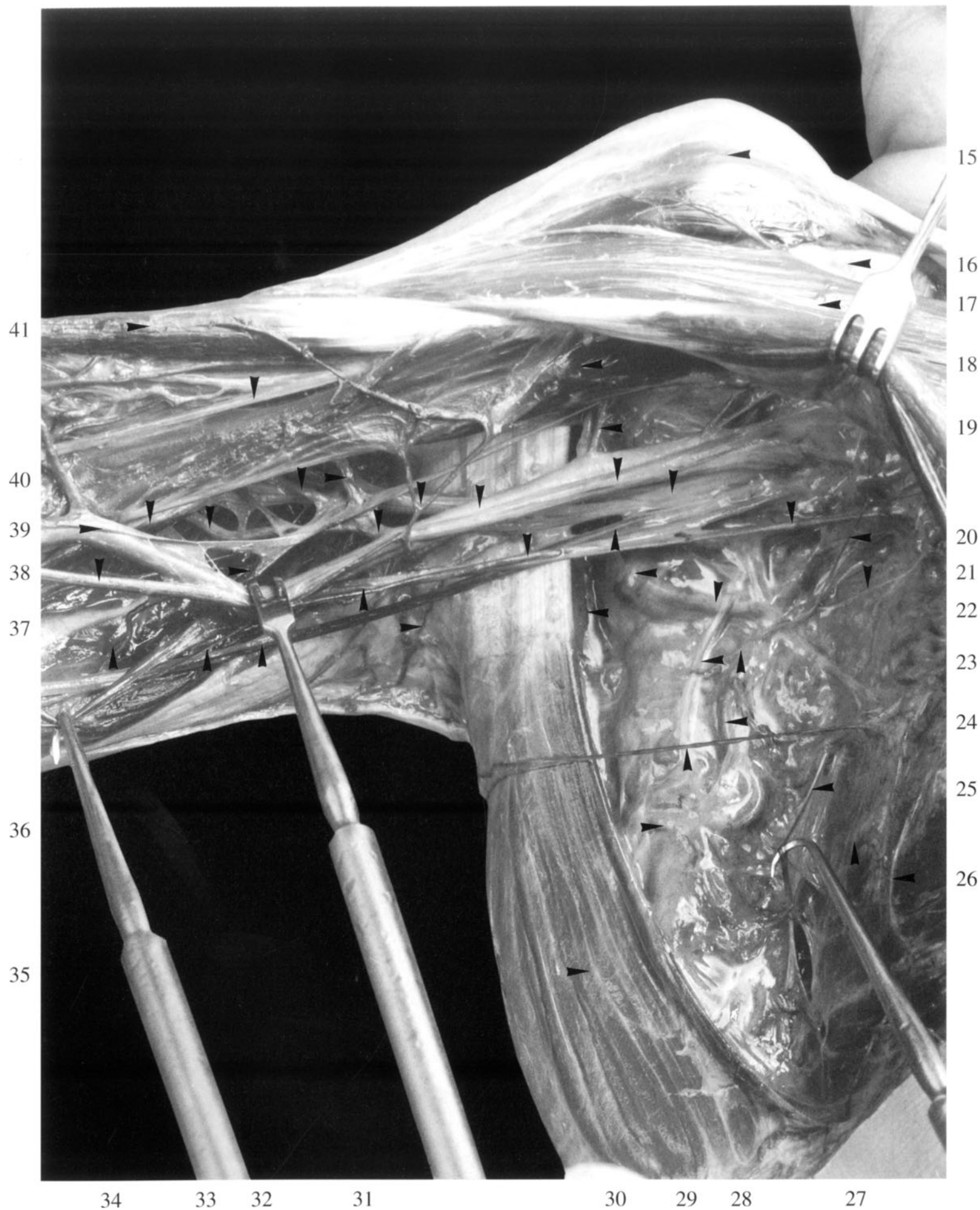


Figure 142

Arm 1
Superficial Brachial Fascia

- | | | | |
|----|---|----|---|
| 1 | Medial brachial cutaneous nerve | 14 | Anastomosis between two branches of medial antebrachial cutaneous nerve |
| 2 | Subcutaneous tissue | 15 | Lateral antebrachial cutaneous nerve |
| 3 | Brachial artery (cutaneous branch) | 16 | Lateral antebrachial cutaneous nerve (recurrent branch) |
| 4 | Intercostobrachial nerve | 17 | Deep layer of stratum subcutaneum (forming roof of flat tunnel for the cutaneous nerve and its accompanying vessel) |
| 5 | Deep layer of stratum subcutaneum (root of a flat tunnel) | 18 | Biceps brachii muscle with superficial brachial fascia |
| 6 | Brachial artery (cutaneous branch) | 19 | Deep layer of stratum subcutaneum |
| 7 | Deep layer of stratum subcutaneum | 20 | Deep layer of stratum subcutaneum (attachment to superficial brachial fascia) |
| 8 | Medial brachial cutaneous nerve | 21 | Medial antebrachial cutaneous nerve (brachial cutaneous branch) |
| 9 | Deep layer of stratum subcutaneum (cut edge) | | |
| 10 | Triceps brachii muscle (long head) with superficial brachial fascia | | |
| 11 | Subcutaneous tissue | | |
| 12 | Subcutaneous fascia | | |
| 13 | Superficial brachial fascia (not reinforced by deep layer of stratum subcutaneum) | | |

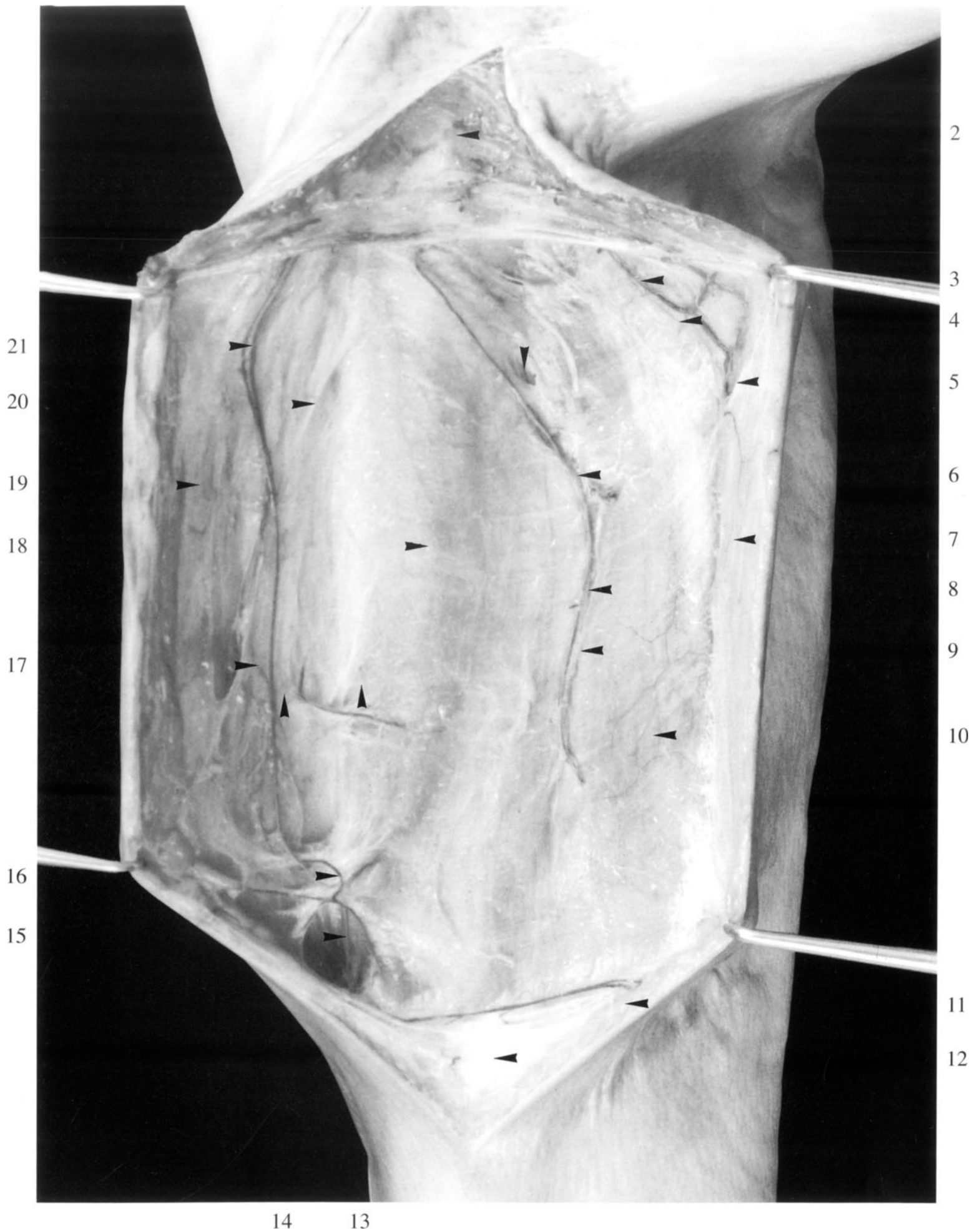
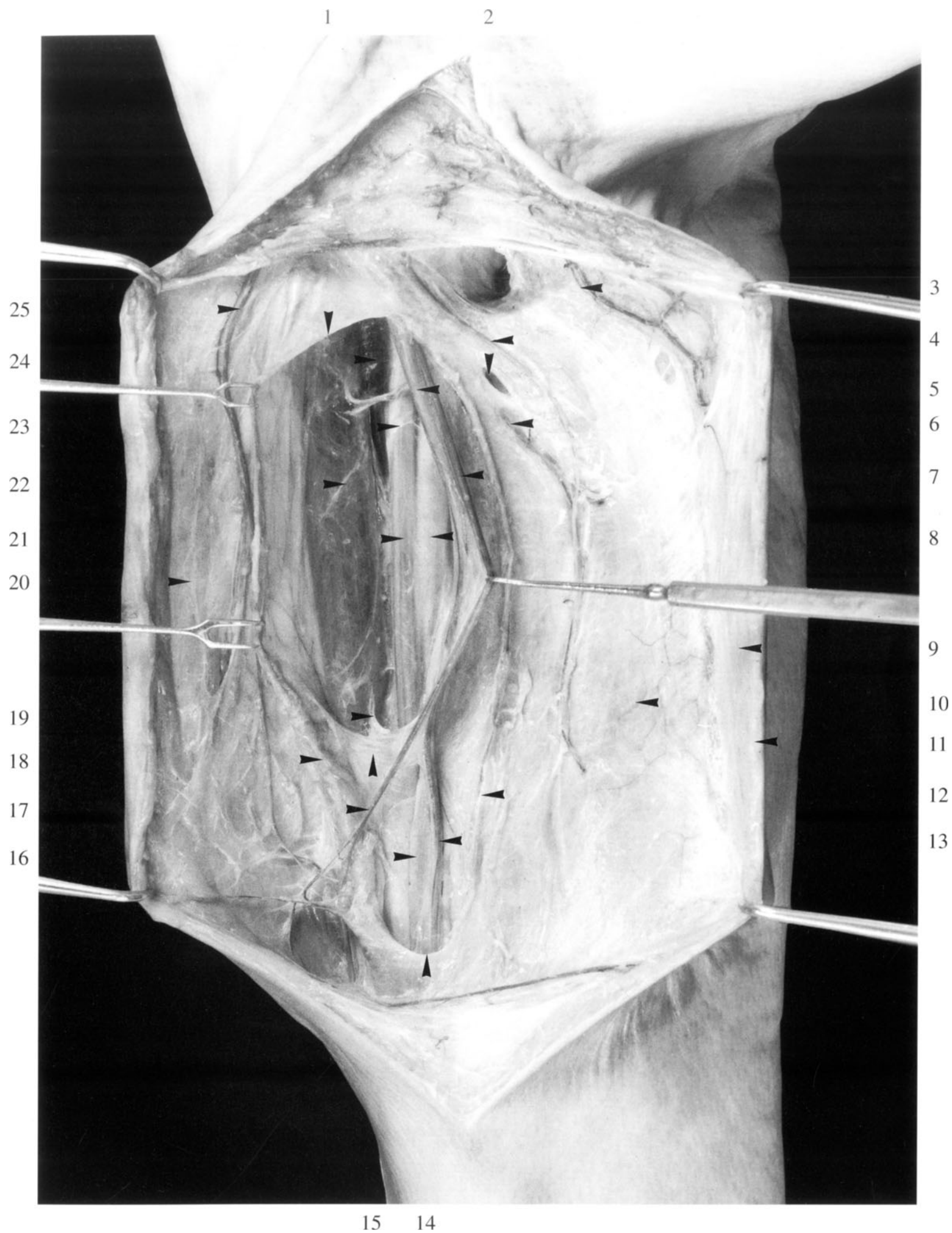


Figure 143

Arm 2
Medial Bicipital Sulcus

- | | | | |
|----|---|----|--|
| 1 | Superficial brachial fascia | 15 | Floor of flat tunnel transmitting basilic vein |
| 2 | Medial brachial cutaneous nerve | 16 | Basilic vein |
| 3 | Intercostobrachial nerve | 17 | Medial antebrachial cutaneous nerve
(brachial cutaneous branch,
forming an additional collateral branch) |
| 4 | Medial brachial cutaneous nerve | 18 | Deep layer of stratum subcutaneum
(cut edge of attachment of flat tunnel roof) |
| 5 | Basilic vein | 19 | Neurovascular bundle of arm (cut edge) |
| 6 | Brachial artery (cutaneous branch) | 20 | Deep layer of stratum subcutaneum |
| 7 | Medial antebrachial cutaneous nerve | 21 | Median nerve |
| 8 | Brachial artery | 22 | Biceps brachii muscle |
| 9 | Deep layer of stratum subcutaneum | 23 | Neurovascular bundle of arm (cut edge) |
| 10 | Triceps brachii muscle (long head)
with superficial brachial fascia | 24 | Coracobrachialis muscle |
| 11 | Subcutaneous tissue (cut edge) | 25 | Medial antebrachial cutaneous nerve
(brachial cutaneous branch) |
| 12 | Deep layer of stratum subcutaneum
(cut edge of attachment of flat tunnel roof) | | |
| 13 | Medial antebrachial cutaneous nerve | | |
| 14 | Deep layer of stratum subcutaneum
(cut edge of flat tunnel roof) | | |



- | | |
|---|---|
| 1 Medial antebrachial cutaneous nerve
(brachial cutaneous branch) | 19 Ulnar nerve |
| 2 Coracobrachialis muscle | 20 Medial antebrachial cutaneous nerve |
| 3 Brachial artery (musculocutaneous branch) | 21 Triceps brachii muscle (long head) |
| 4 Latissimus dorsi muscle (tendon of insertion) | 22 Triceps brachii muscle
(lateral head with inner fascia) |
| 5 Radial nerve (muscular branch
for long head of triceps brachii muscle) | 23 Triceps brachii muscle (medial head) |
| 6 Triceps brachii muscle (long head) | 24 Medial intermuscular septum of arm |
| 7 Teres major muscle | 25 Brachialis muscle |
| 8 Attachment of latissimus dorsi tendons
and long head to expansion to crest
of lesser tubercle | 26 Biceps brachii muscle |
| 9 Ulnar nerve | 27 Superficial brachial fascia (cut edge) |
| 10 Brachial artery
(muscular branch
for long head of triceps brachii muscle) | 28 Basilic vein |
| 11 Radial nerve (ulnar collateral branch) | 29 Medial antebrachial cutaneous nerve
(brachial cutaneous branch,
forming a collateral branch
to the anterior branch) |
| 12 Profunda brachii artery | 30 Anastomosis of brachial vein with basilic vein |
| 13 Radial nerve | 31 Medial antebrachial cutaneous nerve |
| 14 Triceps brachii muscle
(lateral head, cut edge of inner fascia) | 32 Medial intermuscular septum of arm |
| 15 Medial brachial cutaneous nerve | 33 Radial collateral artery (origin) |
| 16 Superior ulnar collateral artery | 34 Basilic vein |
| 17 Radial nerve (ulnar collateral branch) | 35 Median nerve |
| 18 Triceps brachii muscle (medial head) | 36 Brachial artery |
| | 37 Triceps brachii muscle
(lateral head with inner fascia) |
| | 38 Basilic vein |



Figure 145

Arm 4
Posterior Brachial Region 1

- | | | | |
|---|---|----|--|
| 1 | Skin (cut edge) | 10 | Radial collateral artery (posterior branch) |
| 2 | Subcutaneous tissue | 11 | Radial collateral artery (anterior branch) |
| 3 | Triceps brachii muscle (long head) | 12 | Radial collateral artery (anterior branch) |
| 4 | Deltoid muscle (location of posterior border) | 13 | Lateral epicondyle |
| 5 | Superficial brachial fascia (cut edge) | 14 | Triceps brachii muscle (lateral head) |
| 6 | Triceps brachii muscle (lateral head) | 15 | Triceps brachii muscle (tendon of insertion) |
| 7 | Superficial brachial fascia | 16 | Posterior antebrachial cutaneous nerve |
| 8 | Lateral intermuscular septum of arm | 17 | Superficial brachial fascia (cut edge) |
| 9 | Triceps brachii muscle (medial head) | | |



Figure 146

Arm 5
Posterior Brachial Region 2
Locating the Radial Nerve 1

- | | | | |
|---|---|----|--|
| 1 | Humerus
(behind inner fascia of triceps lateral head) | 10 | Extensor carpi radialis longus muscle
with superficial fascia |
| 2 | Radial nerve
(behind inner fascia of triceps lateral head) | 11 | Olecranon |
| 3 | Triceps brachii muscle
(medial head behind inner fascia of lateral head) | 12 | Lateral epicondyle of humerus |
| 4 | Triceps brachii muscle (lateral head) | 13 | Triceps brachii muscle (medial head) |
| 5 | Superficial brachial fascia | 14 | Triceps brachii muscle (tendon of insertion) |
| 6 | Posterior antebrachial cutaneous nerve | 15 | Superficial brachial fascia |
| 7 | Lateral intermuscular septum of arm | 16 | Deep tendon of triceps brachii muscle |
| 8 | Posterior antebrachial cutaneous nerve
(moderately long side branch) | 17 | Triceps brachii muscle (long head) |
| 9 | Brachioradialis muscle with superficial fascia | 18 | Inner [deep] fascia of lateral head
of triceps brachii muscle |
| | | 19 | Deltoid muscle |



Figure 147

Arm 6
Posterior Brachial Region 3
Locating the Radial Nerve 2

- | | | | |
|----|---|----|---|
| 1 | Triceps brachii muscle (long head) | 12 | Posterior antebrachial cutaneous nerve
(moderately long side branch) |
| 2 | Radial nerve | 13 | Extensor carpi radialis muscle
with superficial fascia |
| 3 | Humerus | 14 | Brachioradialis muscle with superficial fascia |
| 4 | Radial collateral artery | 15 | Triceps brachii muscle (medial head) |
| 5 | Triceps brachii muscle (medial head) | 16 | Triceps brachii muscle (tendon of insertion) |
| 6 | Triceps brachii muscle (lateral head) | 17 | Posterior antebrachial cutaneous nerve |
| 7 | Superficial brachial fascia | 18 | Superficial brachial fascia (cut edge) |
| 8 | Lateral intermuscular septum of arm | 19 | Deep tendon of triceps brachii muscle |
| 9 | Brachioradialis muscle
with superficial brachial fascia | 20 | Middle collateral artery |
| 10 | Posterior antebrachial cutaneous nerve
(short superficial side branches) | 21 | Deep tendon of triceps brachii muscle |
| 11 | Posterior antebrachial cutaneous nerve
(long, deep side branch) | | |

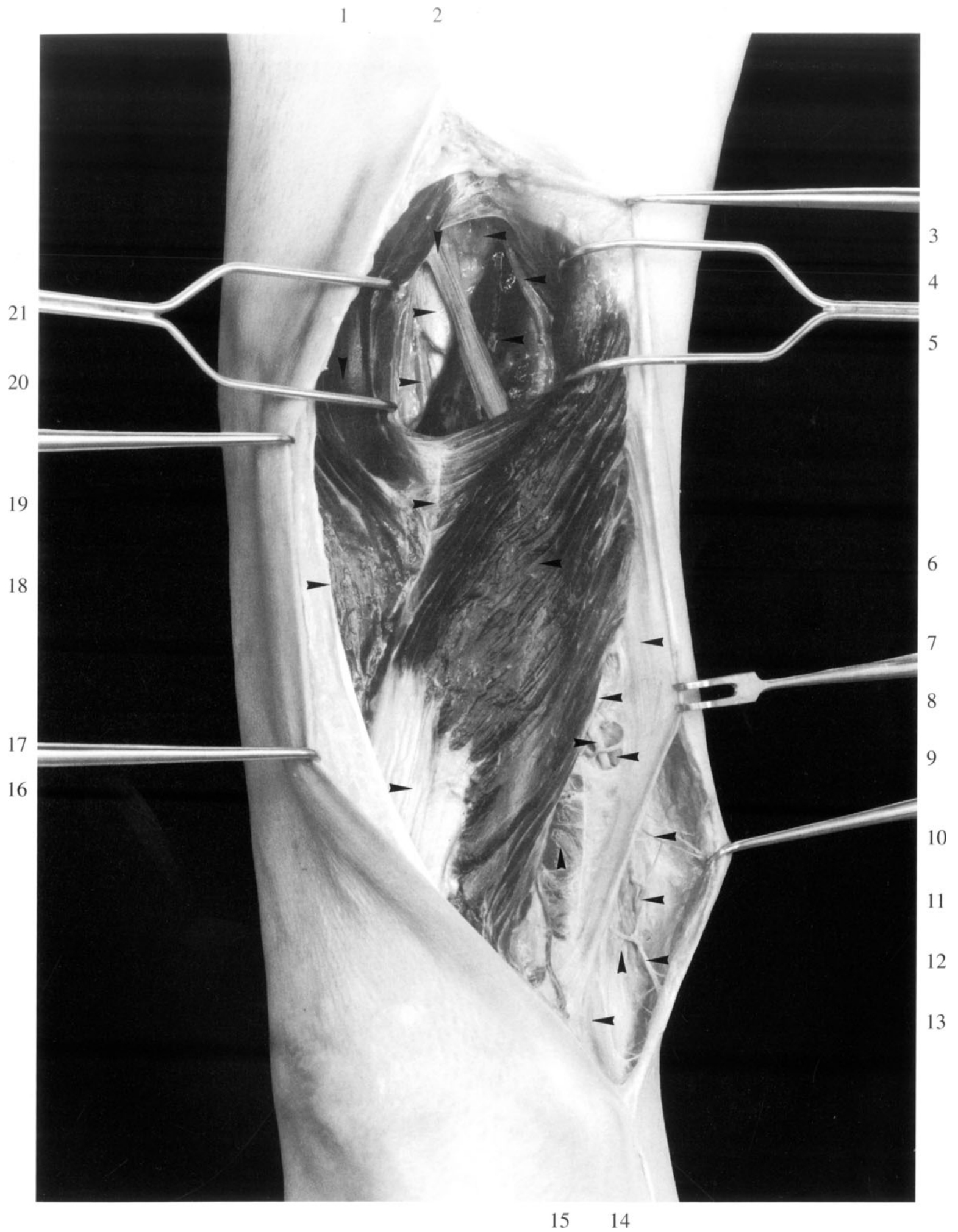


Figure 148**Arm 7
Posterior Brachial Region 4
Locating the Radial Nerve 3**

- | | | | |
|----|---|----|--|
| 1 | Triceps brachii muscle (long head) | 18 | Triceps brachii muscle (medial head) |
| 2 | Radial nerve | 19 | Triceps brachii muscle (lateral head, cut surface) |
| 3 | Triceps brachii muscle (lateral head, cut surface) | 20 | Triceps brachii muscle
(tendon of insertion above olecranon) |
| 4 | Triceps brachii muscle (lateral head, cut surface) | 21 | Lateral epicondyle |
| 5 | Triceps brachii muscle (medial head) | 22 | Extensor carpi radialis longus muscle,
overlapped by fasciae |
| 6 | Humerus | 23 | Posterior antebrachial cutaneous nerve
(deeper side branch) |
| 7 | Inferior lateral brachial cutaneous nerve | 24 | Triceps brachii muscle (tendon of insertion) |
| 8 | Triceps brachii muscle
(lateral head, tendon of origin) | 25 | Radial collateral artery (posterior branch) |
| 9 | Tendinous band of lateral head | 26 | Superficial brachial fascia (cut edge) |
| 10 | Posterior antebrachial cutaneous nerve | 27 | Triceps brachii muscle (medial head) |
| 11 | Tendinous band of lateral head | 28 | Radial collateral artery |
| 12 | Radial collateral artery (anterior branch) | 29 | Radial nerve
(muscular branch for lateral
and medial heads of triceps) |
| 13 | Superficial brachial fascia | 30 | Radial nerve
(muscular branch for medial head of triceps) |
| 14 | Superficial brachial fascia
(attachment to lateral intermuscular septum) | 31 | Middle collateral artery |
| 15 | Cephalic vein | | |
| 16 | Posterior antebrachial cutaneous nerve
(superficial side branch) | | |
| 17 | Brachioradialis muscle
covered by superficial brachial fascia | | |



Figure 149

Anterior Cubital Region 1
Subcutaneous Veins 1

- | | |
|--|---|
| 1 Cephalic vein covered by subcutaneous tissue | 7 Median basilic vein |
| 2 Flexor muscles of arm with subcutaneous tissue | covered by subcutaneous tissue |
| 3 Medial bicipital sulcus | 8 Brachioradialis muscles and forearm extensors |
| 4 Superficial subcutaneous vein | with subcutaneous tissue |
| 5 Basilic vein covered by subcutaneous tissue | 9 Subcutaneous vein of middle layer |
| 6 Flexor muscles of forearm | 10 Cubital fossa |
| with subcutaneous tissue | 11 Median cephalic vein |
| | covered by subcutaneous tissue |



1

2

3

4

5

11

10

9

8

7

6

Figure 150

Anterior Cubital Region 2
Subcutaneous Veins 2

- | | |
|---|--|
| 1 Cephalic vein | 13 Pronator teres muscle |
| 2 Biceps brachii muscle | with superficial antebrachial fascia |
| 3 Superficial brachial fascia | 14 Lateral antebrachial sulcus |
| 4 Brachialis muscle | 15 Brachioradialis muscle |
| 5 Basilic vein | with superficial antebrachial fascia |
| 6 Medial intermuscular septum of arm | 16 Median antebrachial vein |
| 7 Medial antebrachial cutaneous nerve | 17 Median profunda vein |
| (posterior branch) | 18 Cephalic vein |
| 8 Medial antebrachial cutaneous nerve | 19 Median profunda vein |
| (anterior branch) | 20 Median cephalic vein |
| 9 Bicipital aponeurosis [lacertus fibrosus] | 21 Lateral antebrachial cutaneous nerve |
| 10 Median basilic vein | 22 Biceps brachii muscle (tendon of insertion) |
| 11 Basilic vein | 23 Biceps brachii muscle |
| 12 Common head of flexor muscles | (variant with aponeurotic expansion |
| with superficial antebrachial fascia | to brachioradialis muscle) |



Figure 151

**Anterior Cubital Region 3
Tissues Supporting
the Subcutaneous Veins and Nerves**

- | | |
|--|--|
| 1 Cephalic vein | 12 Brachioradialis muscle |
| 2 Biceps brachii muscle | 13 Cephalic vein
(replaces transposed median antebrachial vein) |
| 3 Fat in flat tunnel transmitting basilic vein | 14 Cephalic vein
(segment arising from median cephalic vein) |
| 4 Medial epicondyle of humerus | 15 Accessory cephalic vein |
| 5 Medial antebrachial cutaneous nerve
(anterior branch) | 16 Medial antebrachial cutaneous nerve
(collateral branches to anterior branch) |
| 6 Basilic vein | |
| 7 Basilic vein | |
| 8 Median cubital vein | |
| 9 Median antebrachial vein (transposed) | |
| 10 Common head of flexor muscles | |
| 11 Fat in flat tunnel
transmitting median cubital vein | |

All the named structures are covered either by superficial fascia or by the deep layer of the stratum subcutaneum forming the roof of a flat tunnel.

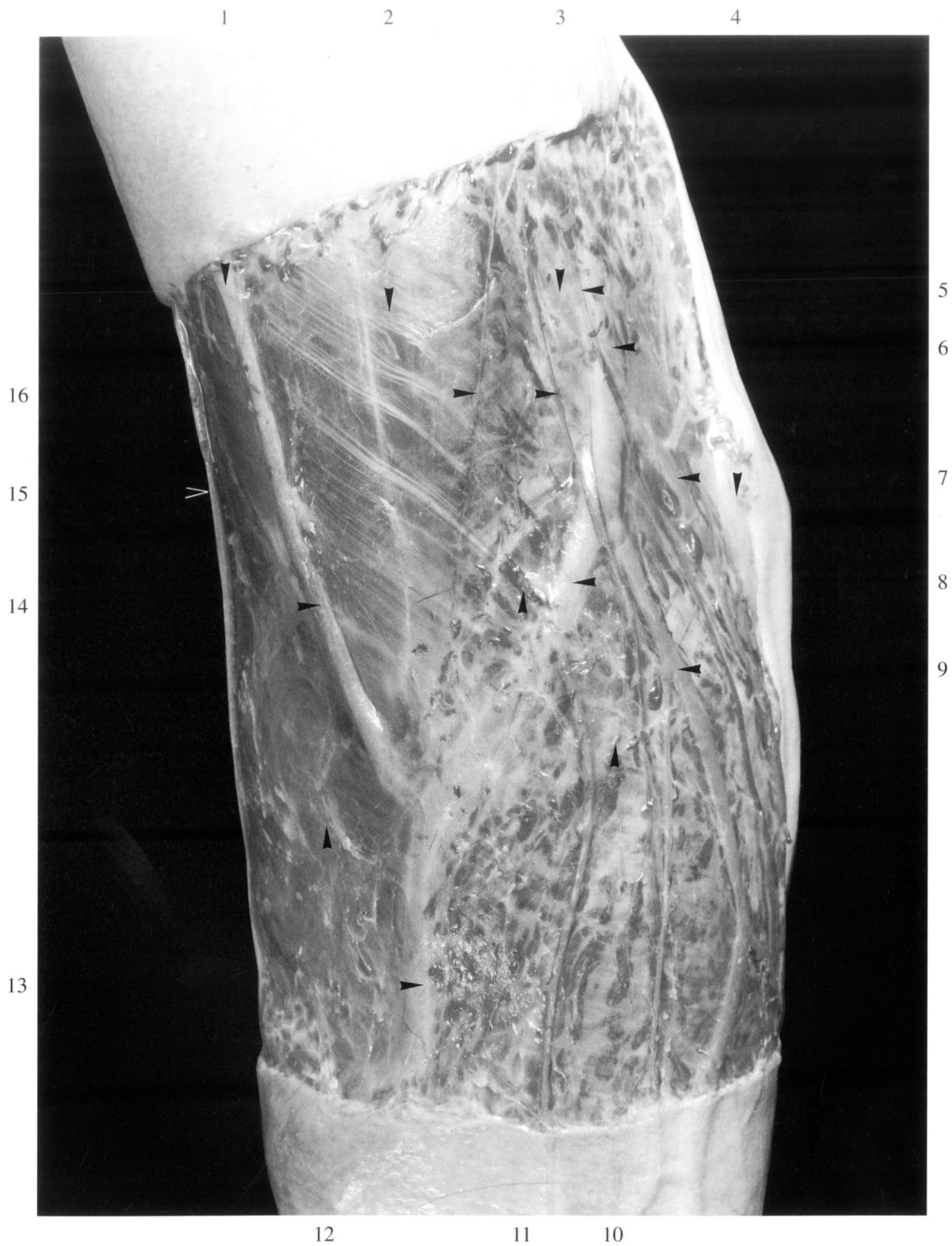


Figure 152

**Anterior Cubital Region 4
Locating the Median Basilic Vein
(Median Cubital Vein)
Venous Access**

- | | |
|---|---|
| 1 Biceps brachii muscle | 12 Brachioradialis muscle |
| 2 Fat in flat tunnel for median basilic vein | 13 Pronator teres muscle |
| 3 Medial bicipital sulcus | 14 Median cephalic vein |
| 4 Medial epicondyle of humerus | 15 Deep layer of stratum subcutaneum,
forming roof of flat tunnel
for median basilic vein |
| 5 Biceps brachii muscle (tendon of insertion) | 16 Skin (cut edge) |
| 6 Subcutaneous tissue | 17 Cubital fossa
(deepest part, radial to palpable biceps tendon) |
| 7 Median basilic vein | 18 Lateral bicipital sulcus |
| 8 Subcutaneous tissue | |
| 9 Flexor carpi ulnaris muscle | |
| 10 Median antebrachial vein | |
| 11 Radial sulcus of forearm | |

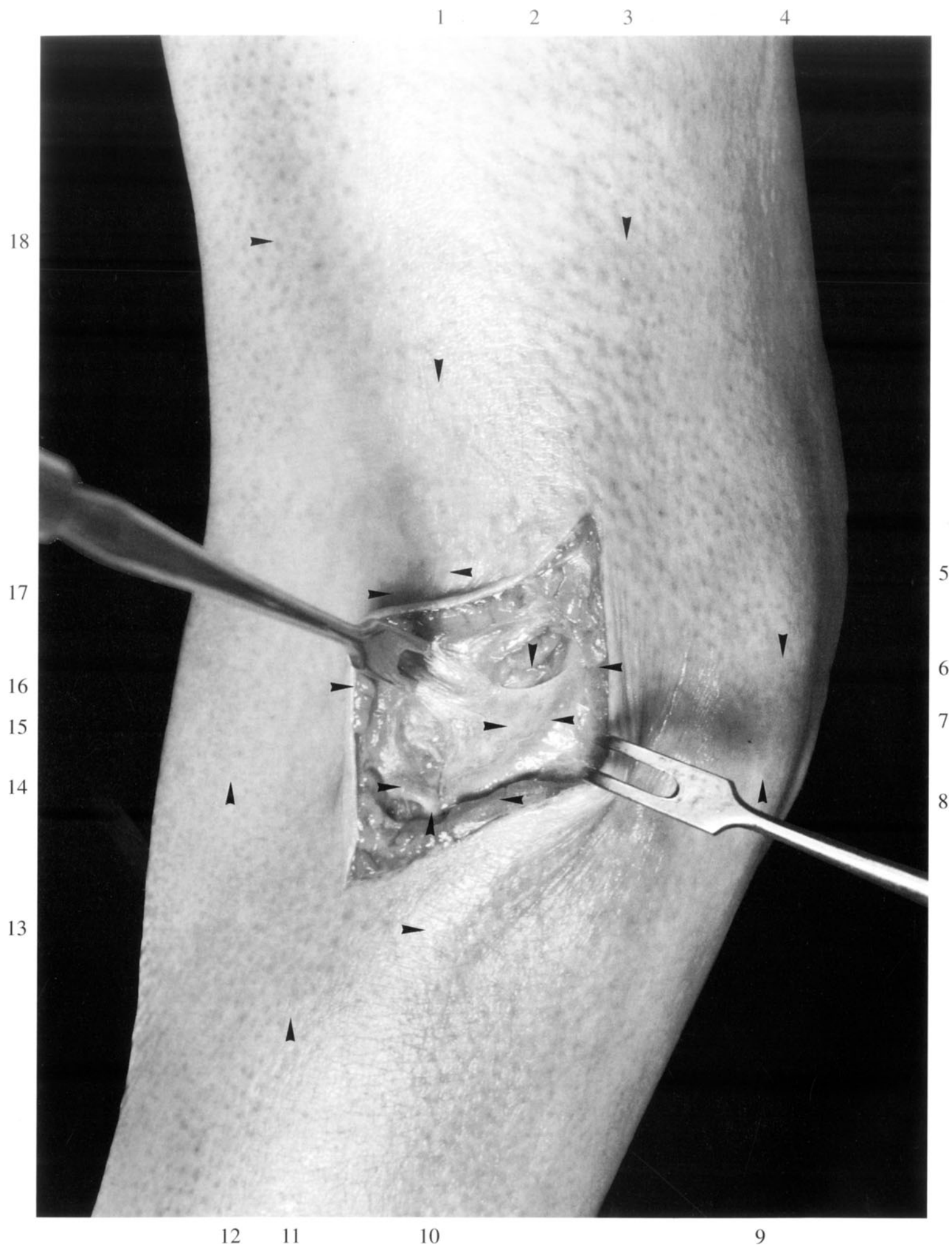


Figure 153

**Anterior Cubital Region 5
Superficial Fascia
and the Subcutaneous Veins and Nerves**

- | | |
|--|--|
| 1 Cephalic vein | 13 Median antebrachial vein |
| 2 Biceps brachii muscle | 14 Medial epicondyle of humerus |
| 3 Superficial brachial fascia (cut edge) | 15 Biceps brachii muscle (tendon of insertion) |
| 4 Medial intermuscular septum of arm | 16 Brachioradialis muscle |
| 5 Triceps brachii muscle | with superficial antebrachial fascia |
| (medial head with superficial brachial fascia) | 17 Valve of cephalic vein |
| 6 Medial antebrachial cutaneous nerve | 18 Cephalic vein |
| (anterior branch) | (replaces transposed median antebrachial vein) |
| 7 Medial antebrachial cutaneous nerve | 19 Pronator teres muscle |
| (posterior branch) | with superficial antebrachial fascia |
| 8 Basilic vein | 20 Bicipital aponeurosis |
| 9 Basilic vein | 21 Superficial brachial fascia (cut edge) |
| 10 Venous valves | 22 Cephalic vein |
| 11 Median cubital vein | (segment arising from median cephalic vein) |
| 12 Median antebrachial vein | 23 Accessory cephalic vein |
| (variant draining to median cubital vein) | |



Figure 154**Anterior Cubital Region 6
Variability of the Subcutaneous Veins**

- | | |
|--|--|
| 1 Cephalic vein | 21 Cephalic vein |
| 2 Biceps brachii muscle | 22 Brachioradialis muscle |
| 3 Bicipital aponeurosis | 23 Median antebrachial vein (transposed) |
| 4 Basilic vein | 24 Median profunda vein |
| 5 Basilic vein | 25 Cephalic vein |
| 6 Biceps brachii muscle | 26 Lateral antebrachial cutaneous nerve |
| 7 Basilic vein | 27 Median cubital vein |
| 8 Brachialis muscle | 28 Cephalic vein |
| 9 Pronator teres muscle | (replaces transposed median antebrachial vein) |
| 10 Median basilic vein | 29 Cephalic vein |
| 11 Biceps brachii muscle (tendon of insertion) | 30 Median antebrachial vein (transposed) |
| 12 Median cephalic vein | 31 Median basilic vein (thrombosed) |
| 13 Basilic vein | 32 Median cephalic vein |
| 14 Median antebrachial vein | 33 Basilic vein (thrombosed) |
| 15 Brachioradialis muscle | 34 Median antebrachial vein |
| 16 Medial antebrachial cutaneous nerve | 35 Brachioradialis muscle |
| (posterior branch) | 36 Median cephalic vein |
| 17 Basilic vein | 37 Median basilic vein |
| 18 Superficial brachial fascia (cut edge) | 38 Lateral antebrachial cutaneous nerve |
| 19 Brachial artery and biceps brachii muscle | 39 Medial antebrachial cutaneous nerve |
| 20 Basilic vein | (anterior branch) |
| and medial antebrachial cutaneous nerve | 40 Medial intermuscular septum of arm |
| (anterior branch) | |

1 2 3 4 5

6 7 8

40
39
38
37
36
35
34



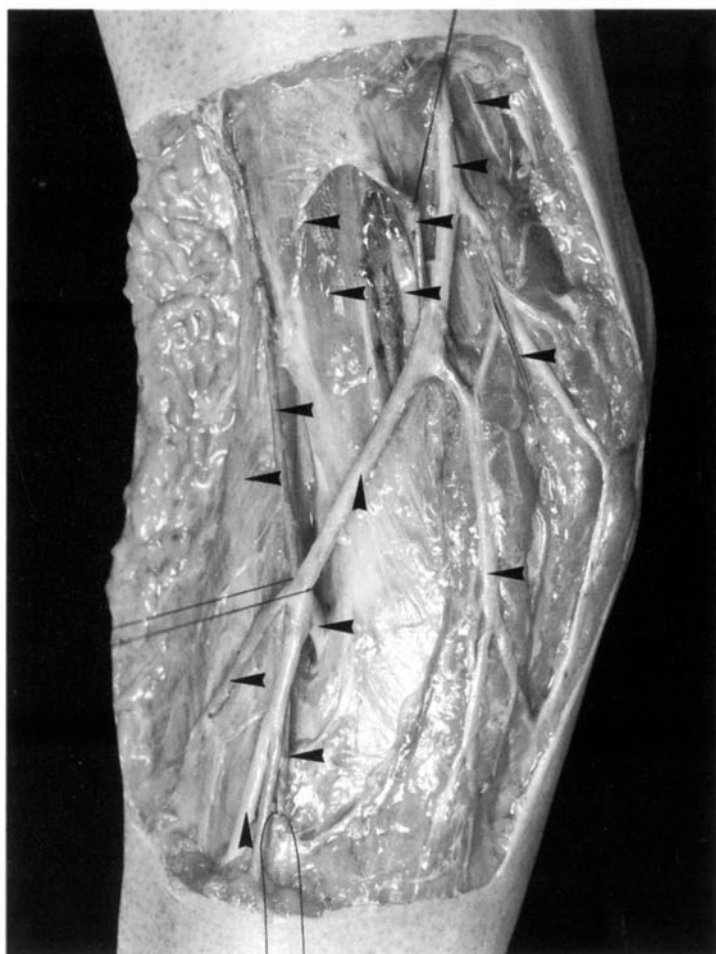
9
10
11
12
13
14
15



33
32
31
30



16
17
18
19
20
21
22
23
24
25
26



29

28 27

Figure 155

Anterior Cubital Region 7
Superficial Fascia
Deep Layer, Upper Portion

- | | |
|--|---|
| 1 Biceps brachii muscle | 21 Radial sulcus of forearm |
| 2 Superficial brachial fascia (cut edge) | 22 Brachioradialis muscle |
| 3 Deep layer of stratum subcutaneum (cut edge) | with superficial antebrachial fascia |
| 4 Deep layer of stratum subcutaneum (cut edge) | 23 Brachioradialis muscle |
| 5 Subcutaneous tissue | with superficial antebrachial fascia |
| 6 Medial antebrachial cutaneous nerve | 24 Deep layer of stratum subcutaneum (cut edge) |
| (anterior branch) | 25 Median antebrachial vein |
| 7 Median nerve | 26 Lateral antebrachial cutaneous nerve |
| 8 Medial intermuscular septum of arm | 27 Median profunda vein |
| 9 Basilic vein | 28 Median basilic vein (cut edge) |
| 10 Brachialis muscle | 29 Biceps brachii muscle (tendon of insertion) |
| 11 Median basilic vein [vena comitans] | 30 Median cephalic vein |
| 12 Median basilic vein (resected) | 31 Cephalic vein |
| 13 Fascia supplementing skeletal attachment | 32 Deep layer of stratum subcutaneum |
| of common head | (forming roof of flat tunnel for cephalic vein) |
| 14 Pronator teres muscle | 33 Lateral brachial vein [vena comitans] |
| 15 Bicipital aponeurosis | 34 Cephalic vein |
| 16 Superficial antebrachial fascia (cut edge) | 35 Lateral intermuscular septum of arm |
| 17 Flexor carpi ulnaris muscle | 36 Superficial brachial fascia (cut edge) |
| with superficial antebrachial fascia | 37 Brachial artery |
| 18 Deep layer of stratum subcutaneum | with venae comitantes in vascular sheath |
| 19 Common head of flexor muscles | 38 Fatty tissue in flat tunnel for basilic vein |
| 20 Flexor carpi radialis muscle | |
| with superficial antebrachial fascia | |

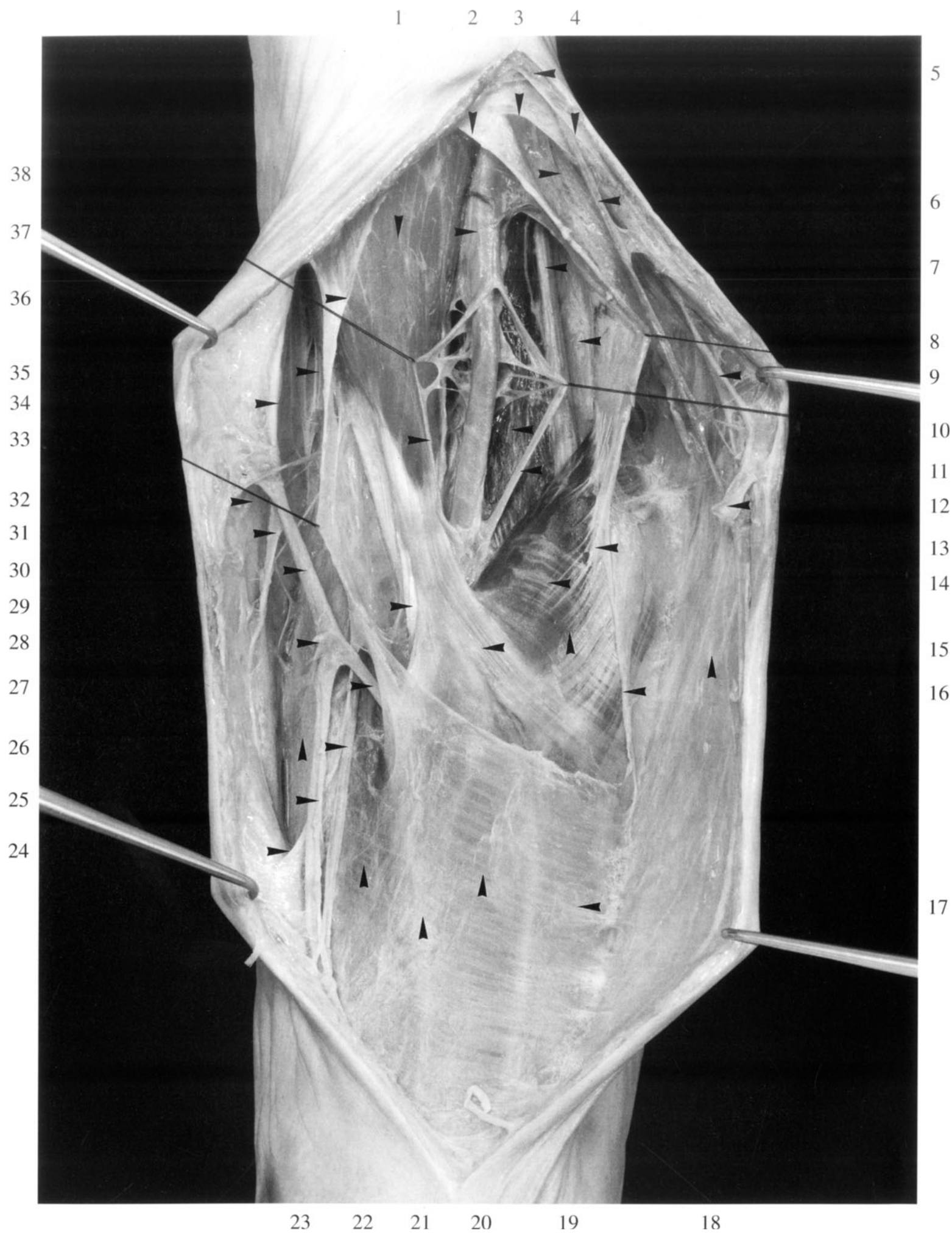


Figure 156**Anterior Cubital Region 8
Deep Layer, Lower Portion 1**

- | | |
|--|--|
| 1 Cephalic vein (in fatty tissue of flat tunnel) | 17 Radial nerve (deep branch) |
| 2 Superficial brachial fascia | 18 Brachial artery |
| 3 Biceps brachii muscle | 19 Superficial antebrachial fascia (cut edge) |
| 4 Deep layer of stratum subcutaneum
(forming roof of flat tunnel for the basilic vein,
cut edge) | 20 Supinator muscle |
| 5 Deep layer of stratum subcutaneum
(cut edge of root of flat tunnel for basilic vein) | 21 Flexor carpi radialis muscle |
| 6 Brachial artery | 22 Bicipital aponeurosis
[lacertus fibrosus] |
| 7 Medial antebrachial cutaneous nerve
(posterior branch) | 23 Pronator teres muscle |
| 8 Medial antebrachial cutaneous nerve
(anterior branch) | 24 Supinator muscle |
| 9 Median basilic vein [vena comitans] | 25 Brachioradialis muscle |
| 10 Basilic vein | 26 Radial artery |
| 11 Median nerve | 27 Radial nerve (superficial branch) |
| 12 Medial intermuscular septum of arm | 28 Median antebrachial vein |
| 13 Brachialis muscle | 29 Radial recurrent artery |
| 14 Median basilic vein (resected) | 30 Radial nerve (superficial branch) |
| 15 Medial antebrachial cutaneous nerve
(anterior branch) | 31 Biceps brachii muscle (tendon of insertion) |
| 16 Common head of flexor muscles | 32 Median cephalic vein |
| | 33 Radial nerve |
| | 34 Lateral antebrachial cutaneous nerve |
| | 35 Brachialis muscle |
| | 36 Fascia between brachialis and biceps brachii
(cut edge) [deep brachial fascia] |

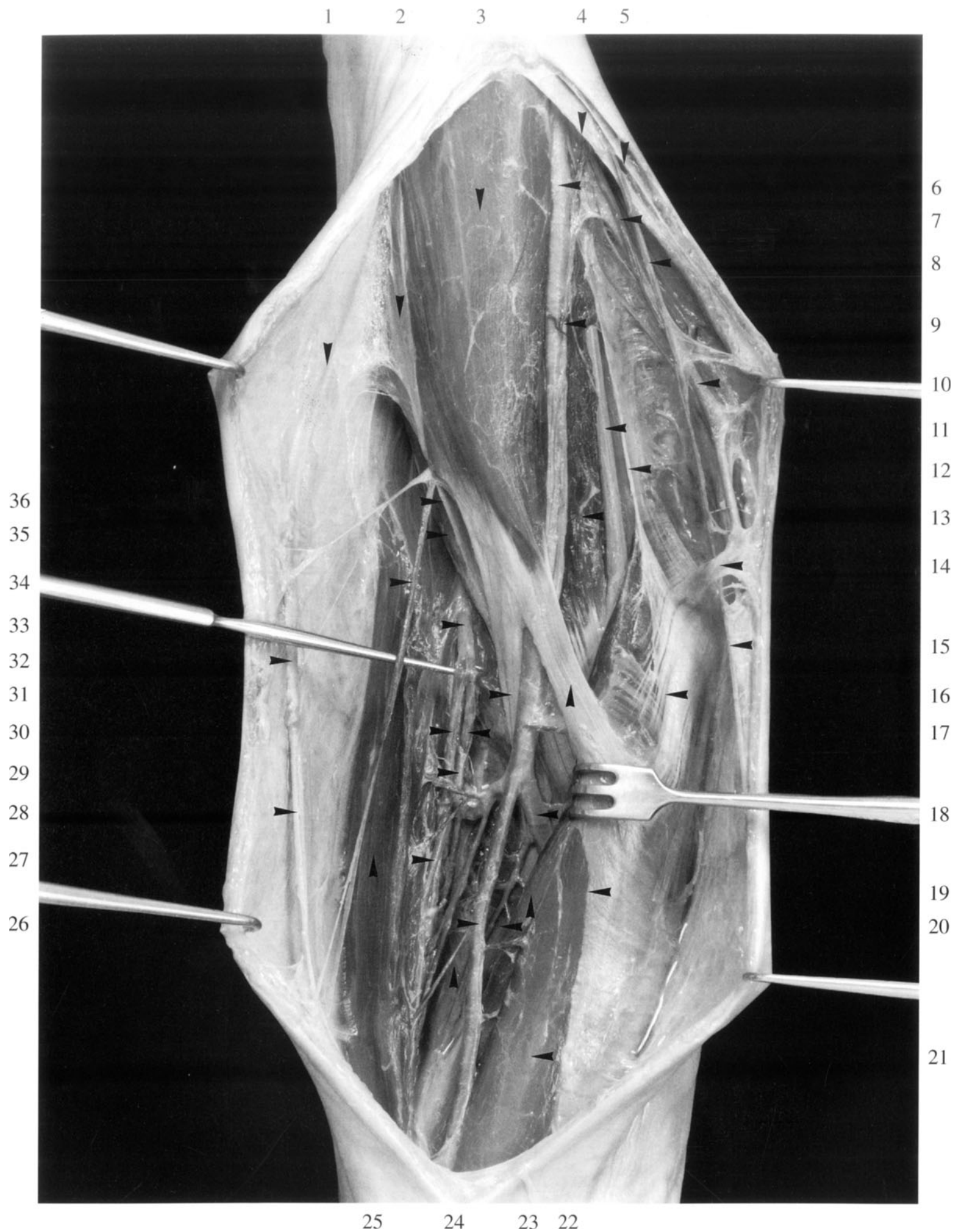


Figure 157

**Anterior Cubital Region 9
Deep Layer, Lower Portion 2**

- | | | | |
|----|---|----|---|
| 1 | Superficial brachial fascia | 18 | Supinator muscle |
| 2 | Biceps brachii muscle | 19 | Radial recurrent artery (muscular branch) |
| 3 | Brachial artery | 20 | Brachioradialis muscle |
| 4 | Medial antebrachial cutaneous nerve
(posterior branch) | 21 | Pronator teres muscle (tendon of insertion) |
| 5 | Median nerve | 22 | Radial nerve (superficial branch) |
| 6 | Medial antebrachial cutaneous nerve
(anterior branch) | 23 | Flexor digitorum superficialis muscle
(ulnar slip of humero-ulnar head) |
| 7 | Basilic vein | 24 | Extensor carpi radialis brevis muscle |
| 8 | Medial intermuscular septum of arm | 25 | Lateral antebrachial cutaneous nerve |
| 9 | Brachialis muscle | 26 | Supinator muscle
(opening for deep branch of radial nerve) |
| 10 | Bicipital aponeurosis | 27 | Radial recurrent artery |
| 11 | Median nerve | 28 | Radial nerve (deep branch) |
| 12 | Biceps brachii muscle (tendon of insertion) | 29 | Humerus (anterolateral surface) |
| 13 | Brachial artery | 30 | Radial nerve |
| 14 | Pronator teres muscle (ulnar head) | 31 | Lateral antebrachial cutaneous nerve |
| 15 | Pronator teres muscle (humeral head) | 32 | Brachioradialis muscle
(retracted from contact area
with brachialis muscle) |
| 16 | Radial artery | | |
| 17 | Ulnar recurrent artery | | |

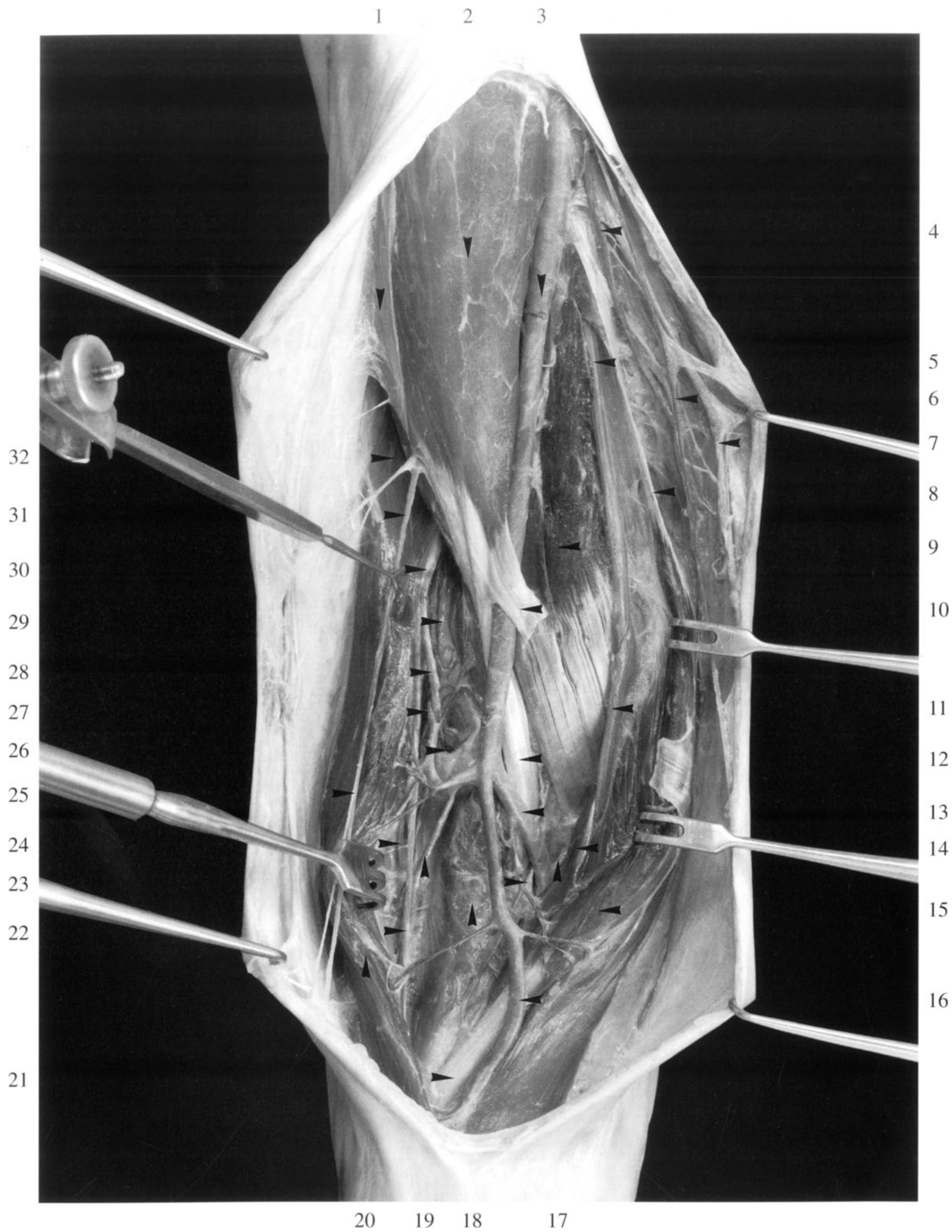


Figure 158

Anterior Antebrachial Region 1
Superficial Layer 1

- | | |
|--|--|
| 1 Biceps brachii muscle (tendon of insertion) | 19 Flexor digitorum superficialis tendon for little finger |
| 2 Bicipital aponeurosis | 20 Flexor digitorum superficialis tendon for middle finger |
| 3 Medial antebrachial cutaneous nerve (anterior branch, collateral branch) | 21 Radial artery (palmar carpal branch) |
| 4 Basilic vein | 22 Median nerve |
| 5 Medial antebrachial cutaneous nerve (anterior branch) | 23 Flexor pollicis longus muscle (tendon of insertion) |
| 6 Median antebrachial vein | 24 Flexor pollicis longus muscle |
| 7 Median cubital vein (resected edge) | 25 Flexor carpi radialis muscle (tendon of insertion) |
| 8 Brachial artery with venae comitantes | 26 Brachioradialis muscle (tendon of insertion) |
| 9 Flexor carpi radialis muscle | 27 Flexor digitorum superficialis muscle (radial head) |
| 10 Palmaris longus muscle (rudimentary tendon, resected) | 28 Venae comitantes of radial artery |
| 11 Flexor carpi ulnaris muscle | 29 Radial nerve (superficial branch) |
| 12 Flexor digitorum superficialis muscle | 30 Radial artery |
| 13 Flexor digitorum profundus muscle | 31 Brachioradialis muscle |
| 14 Ulnar artery with venae comitantes | 32 Pronator teres muscle |
| 15 Ulnar nerve | 33 Cephalic vein and lateral antebrachial cutaneous nerve |
| 16 Flexor digitorum superficialis tendon for index finger | 34 Median profunda vein |
| 17 Flexor carpi ulnaris muscle | 35 Brachial artery |
| 18 Flexor digitorum superficialis tendon for ring finger | 36 Lateral antebrachial cutaneous nerve and cephalic vein |

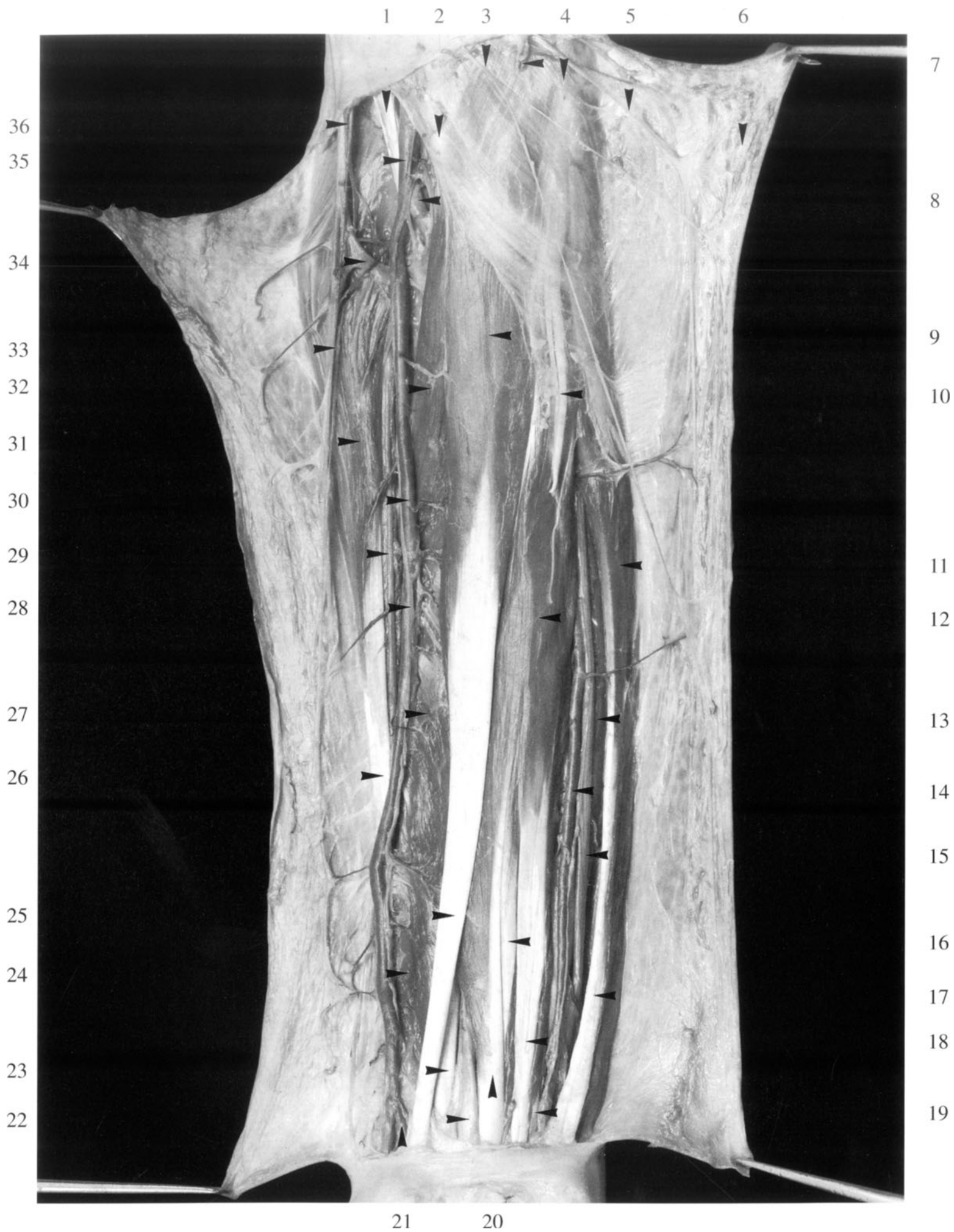


Figure 159

**Antebrachial Region 2
Superficial Layer 2**

- | | | | |
|----|--|----|---|
| 1 | Radial nerve (deep branch) | 23 | Flexor digitorum superficialis tendon for little finger |
| 2 | Bicipital aponeurosis | 24 | Flexor digitorum superficialis tendon for middle finger |
| 3 | Medial antebrachial cutaneous nerve (anterior branch, collateral branch) | 25 | Flexor pollicis longus muscle (tendon of insertion) |
| 4 | Basilic vein | 26 | Median nerve |
| 5 | Medial antebrachial cutaneous nerve (anterior branch) | 27 | Flexor pollicis longus muscle |
| 6 | Median cubital vein (resected) | 28 | Flexor carpi radialis muscle (tendon of insertion) |
| 7 | Median antebrachial vein | 29 | Brachioradialis muscle (tendon of insertion) |
| 8 | Brachial artery | 30 | Flexor digitorum superficialis muscle (radial head) |
| 9 | Brachial artery | 31 | Radial nerve (superficial branch) |
| 10 | Palmaris longus muscle | 32 | Extensor carpi radialis brevis muscle |
| 11 | Flexor carpi radialis muscle | 33 | Radial artery with venae comitantes |
| 12 | Supinator muscle | 34 | Extensor carpi radialis longus muscle (tendon of insertion) |
| 13 | Extensor digitorum muscle | 35 | Cephalic vein and lateral antebrachial cutaneous nerve |
| 14 | Pronator teres muscle | 36 | Extensor carpi radialis brevis muscle |
| 15 | Flexor digitorum profundus muscle | 37 | Extensor carpi radialis longus muscle |
| 16 | Ulnar nerve | 38 | Median cubital vein (lumen with cut edge) |
| 17 | Flexor digitorum superficialis muscle | 39 | Brachioradialis muscle |
| 18 | Ulnar artery with venae comitantes | 40 | Radial nerve (superficial branch) |
| 19 | Extensor carpi ulnaris muscle | | |
| 20 | Ulnar nerve (dorsal branch) | | |
| 21 | Flexor digitorum profundus muscle | | |
| 22 | Flexor digitorum superficialis tendon for ring finger | | |



Figure 160

**Antebrachial Region 3
Superficial Layer 3
Radial Track**

- | | | | |
|----|---|----|--|
| 1 | Brachioradialis muscle | 20 | Flexor digitorum superficialis muscle
(radial head) |
| 2 | Radial nerve | 21 | Flexor carpi radialis muscle (tendon of insertion) |
| 3 | Brachialis muscle | 22 | Flexor pollicis longus muscle |
| 4 | Brachial artery | 23 | Extensor carpi radialis longus muscle
(tendon of insertion) |
| 5 | Bicipital aponeurosis | 24 | Brachioradialis muscle (tendon of insertion) |
| 6 | Medial antebrachial cutaneous nerve
(anterior branch, collateral branch) | 25 | Extensor carpi radialis brevis muscle |
| 7 | Median cubital vein (resected) | 26 | Radial nerve (superficial branch) |
| 8 | Basilic vein | 27 | Pronator teres muscle (tendon of insertion) |
| 9 | Medial antebrachial cutaneous nerve
(anterior branch) | 28 | Extensor carpi radialis longus muscle
(tendon of insertion) |
| 10 | Median basilic vein [vena comitans] | 29 | Extensor carpi radialis brevis muscle (tendon) |
| 11 | Brachial artery with brachial veins | 30 | Cephalic vein |
| 12 | Median nerve | 31 | Supinator muscle |
| 13 | Median nerve
(muscular branch for pronator teres muscle) | 32 | Extensor carpi radialis brevis muscle |
| 14 | Pronator teres muscle (ulnar head) | 33 | Extensor digitorum muscle |
| 15 | Flexor digitorum superficialis muscle
(humero-ulnar head) | 34 | Brachioradialis muscle |
| 16 | Pronator teres muscle (humeral head) | 35 | Radial artery |
| 17 | Flexor carpi radialis muscle | 36 | Median profunda vein |
| 18 | Flexor digitorum superficialis muscle | 37 | Radial nerve (superficial branch) |
| 19 | Flexor carpi ulnaris muscle | 38 | Radial recurrent artery |
| | | 39 | Cephalic vein
and lateral antebrachial cutaneous nerve |

1 2 3 4 5 6 7 8

9

10

11

12

13

14

15

16

17

18

19

20

21

39

38

37

36

35

34

33

32

31

30

29

28

27

26

25

24

23

22

323

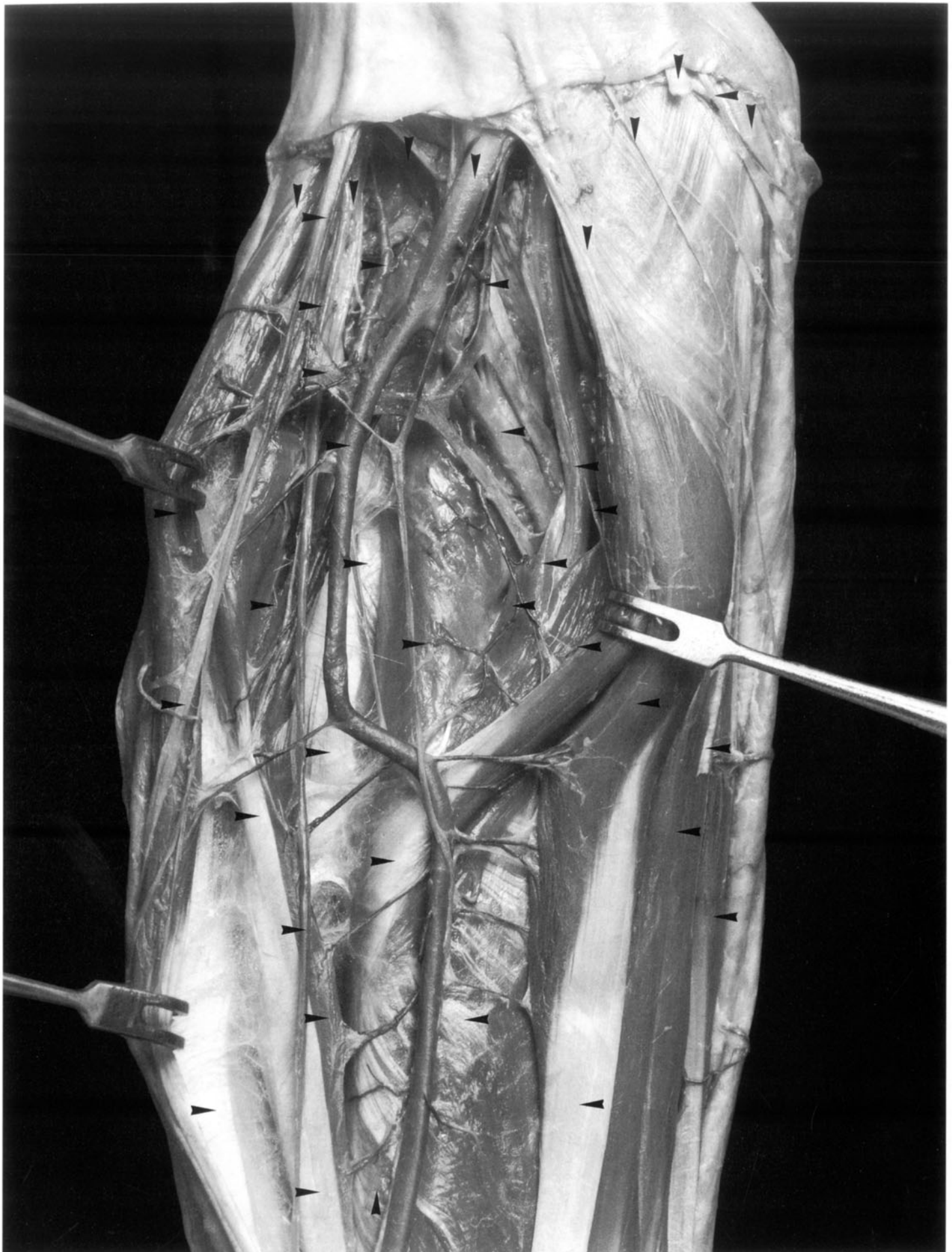


Figure 161

Antebrachial Region 4
Superficial Layer 4
Flexor Digitorum Superficialis Muscle

- | | | | |
|----|--|----|--|
| 1 | Brachioradialis muscle | 21 | Flexor digitorum superficialis tendon for ring finger |
| 2 | Extensor carpi radialis longus muscle | 22 | Flexor digitorum superficialis tendon for middle finger |
| 3 | Radial recurrent artery | 23 | Flexor carpi ulnaris muscle (tendon of insertion) |
| 4 | Brachialis muscle | 24 | Flexor carpi ulnaris muscle (tendon of insertion) |
| 5 | Pronator teres muscle (ulnar head) | 25 | Radial artery (palmar carpal branch) |
| 6 | Pronator teres muscle (humeral head, deep origin from intermuscular aponeurosis) | 26 | Flexor pollicis longus muscle |
| 7 | Pronator teres muscle (humeral head from medial epicondyle) | 27 | Radial artery and venae comitantes |
| 8 | Pronator teres muscle (humeral head from intermuscular aponeurosis) | 28 | Flexor digitorum superficialis muscle (radial head, distal border) |
| 9 | Brachial artery | 29 | Radial nerve (superficial branch) |
| 10 | Median nerve | 30 | Brachioradialis muscle (tendon of insertion) |
| 11 | Biceps brachii muscle (tendon of insertion) | 31 | Extensor carpi radialis longus muscle (tendon of insertion) |
| 12 | Brachial artery | 32 | Extensor carpi radialis brevis muscle |
| 13 | Ulnar recurrent artery | 33 | Pronator teres muscle (muscular insertion) |
| 14 | Intermuscular aponeurosis | 34 | Pronator teres muscle (tendinous insertion) |
| 15 | Median artery | 35 | Extensor carpi radialis brevis muscle (tendon) |
| 16 | Flexor digitorum superficialis muscle (humero-ulnar head) | 36 | Supinator muscle |
| 17 | Flexor carpi radialis muscle | 37 | Radial artery |
| 18 | Flexor digitorum superficialis muscle (radial head) | 38 | Radial nerve (muscular branch for extensor carpi radialis brevis) |
| 19 | Flexor digitorum superficialis muscle | 39 | Radial nerve (deep branch) |
| 20 | Ulnar artery | 40 | Radial nerve (muscular branch for supinator) |
| | | 41 | Radial nerve (superficial branch) |

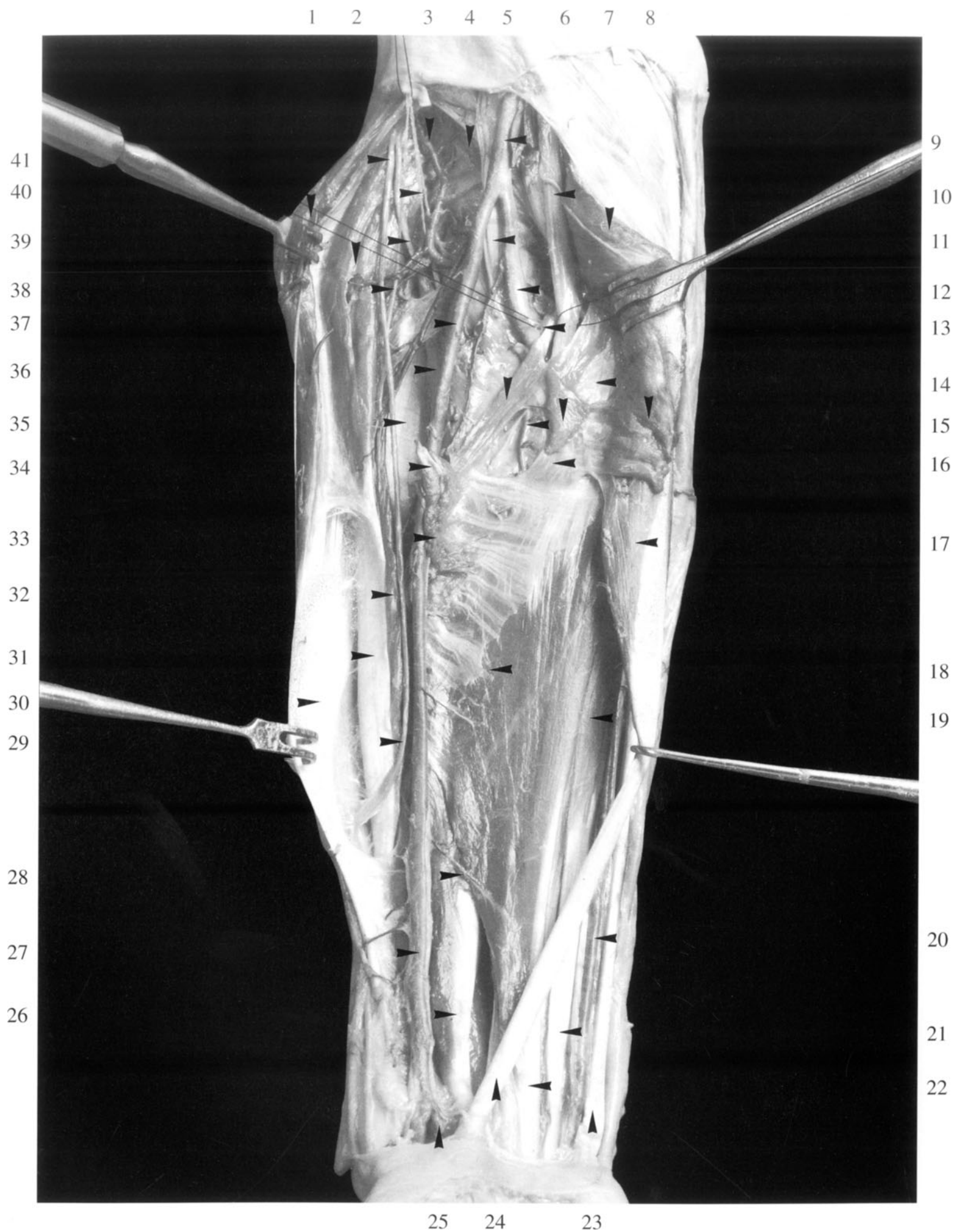


Figure 162**Antebrachial Region 5
Deep Layer 1
Median Nerve**

- | | | | |
|----|---|----|---|
| 1 | Brachioradialis muscle | 20 | Flexor digitorum superficialis muscle
(radial head, cut surfaces) |
| 2 | Radial nerve
(muscular branches for supinator
and extensor carpi radialis brevis muscles) | 21 | Ulnar artery |
| 3 | Head of humerus with articular capsule | 22 | Flexor digitorum superficialis tendon
for ring finger |
| 4 | Brachial artery | 23 | Flexor digitorum superficialis tendon
for middle finger |
| 5 | Bicipital aponeurosis | 24 | Flexor carpi ulnaris muscle (tendon of insertion) |
| 6 | Pronator teres muscle
(humeral head of medial epicondyle) | 25 | Flexor carpi radialis muscle (tendon of insertion) |
| 7 | Median nerve | 26 | Brachioradialis muscle (tendon of insertion) |
| 8 | Biceps brachii muscle (tendon of insertion) | 27 | Flexor pollicis longus muscle |
| 9 | Brachial artery | 28 | Flexor digitorum superficialis muscle
(radial head, distal border) |
| 10 | Ulnar recurrent artery | 29 | Flexor pollicis longus muscle (tendon) |
| 11 | Pronator teres muscle (ulnar head) | 30 | Radial artery |
| 12 | Intermuscular aponeurosis | 31 | Radial nerve (superficial branch) |
| 13 | Pronator teres muscle
(humeral head of intermuscular aponeurosis,
cut surfaces) | 32 | Extensor carpi radialis longus muscle
(tendon of insertion) |
| 14 | Flexor digitorum superficialis muscle
(humero-ulnar head, ulnar slip) | 33 | Pronator teres muscle
(insertion of humeral head) |
| 15 | Median nerve and median artery | 34 | Pronator teres muscle (insertion of ulnar head) |
| 16 | Flexor digitorum superficialis muscle
(radial head, cut edge) | 35 | Extensor carpi radialis brevis muscle (tendon) |
| 17 | Flexor carpi radialis muscle | 36 | Extensor carpi radialis longus muscle |
| 18 | Flexor digitorum superficialis muscle
(radial head, cut surface) | 37 | Supinator muscle |
| 19 | Flexor digitorum superficialis muscle | 38 | Radial artery |
| | | 39 | Radial recurrent artery |
| | | 40 | Radial nerve (deep branch) |
| | | 41 | Radial nerve (superficial branch) |

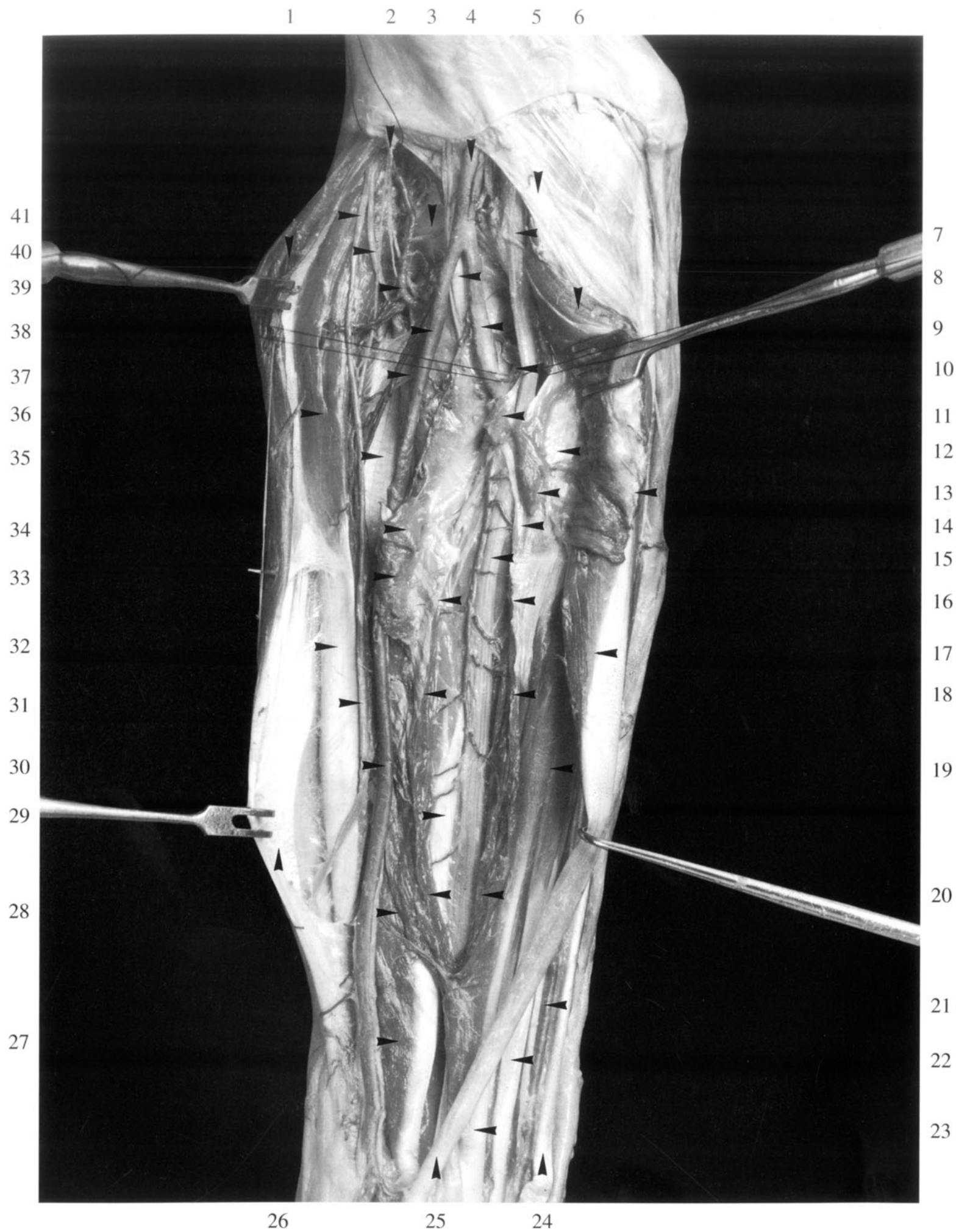


Figure 163

Antebrachial Region 6
Deep Layer 2
Flexor Digitorum Profundus Muscle

- | | | | |
|----|---|----|--|
| 1 | Brachioradialis muscle | 21 | Flexor digitorum superficialis tendon for index finger |
| 2 | Radial nerve (muscular branches for supinator and extensor carpi radialis brevis muscles) | 22 | Flexor carpi radialis muscle (tendon of insertion) |
| 3 | Brachial artery | 23 | Radius (styloid process) |
| 4 | Ulnar artery | 24 | Brachioradialis muscle (tendon of insertion) |
| 5 | Pronator teres muscle (humeral head) | 25 | Pronator quadratus muscle |
| 6 | Flexor carpi radialis muscle | 26 | Radial artery with venae comitantes |
| 7 | Brachial artery | 27 | Flexor pollicis longus muscle |
| 8 | Biceps brachii muscle (tendon of insertion) | 28 | Flexor digitorum superficialis muscle (radial head, cut surface) |
| 9 | Median nerve | 29 | Extensor carpi radialis longus muscle (tendon of insertion) |
| 10 | Ulnar recurrent artery | 30 | Extensor carpi radialis brevis muscle |
| 11 | Pronator teres muscle (ulnar head, cut surface) | 31 | Flexor pollicis longus muscle |
| 12 | Anterior interosseous artery | 32 | Flexor digitorum superficialis muscle (radial head, cut surface) |
| 13 | Median artery | 33 | Pronator teres muscle (humeral head, cut surface) |
| 14 | Flexor digitorum superficialis muscle (radial head, cut surface) | 34 | Radial nerve (superficial branch) |
| 15 | Flexor digitorum profundus muscle | 35 | Radius (anterior surface) |
| 16 | Median nerve | 36 | Pronator teres muscle (ulnar head, cut surface) |
| 17 | Flexor digitorum profundus muscle (tendinous expansion) | 37 | Flexor digitorum superficialis muscle (humero-ulnar head, cut surface of ulnar slip) |
| 18 | Flexor digitorum superficialis tendon for middle finger | 38 | Supinator muscle |
| 19 | Flexor digitorum profundus tendon for index finger | 39 | Extensor carpi radialis longus muscle |
| 20 | Flexor digitorum superficialis muscle (radial head, cut surface) | 40 | Radial recurrent artery |
| | | 41 | Radial nerve (deep branch) |

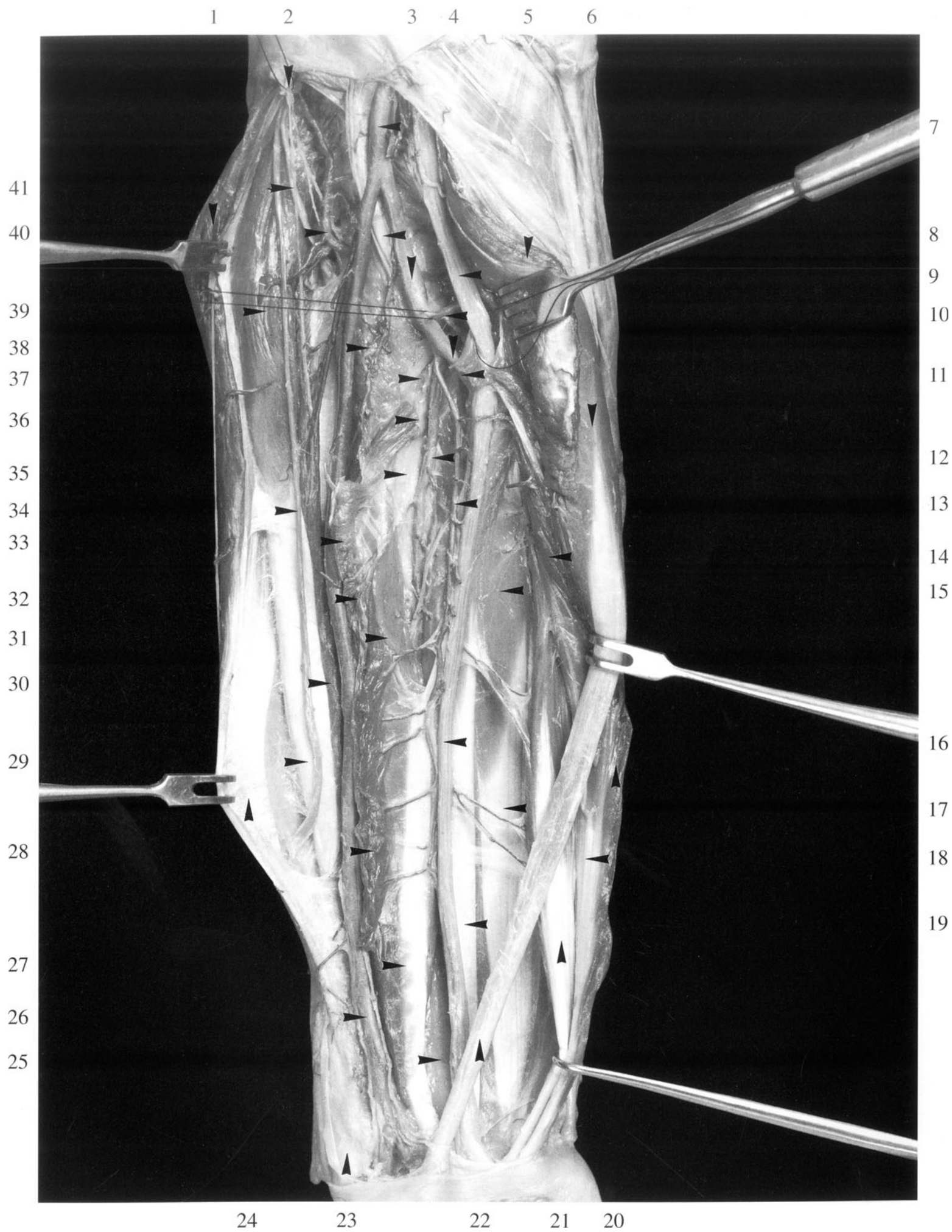


Figure 164 **Antebrachial Region 7**
Deep Layer 3
Common Interosseous Artery
Recurrent Arteries

- | | |
|--|---|
| 1 Brachioradialis muscle | 23 Intermediate tendon |
| 2 Extensor carpi radialis longus muscle | between flexor pollicis longus |
| 3 Radial nerve | and flexor digitorum superficialis muscles |
| 4 Supinator muscle | (formed by fusion of superior belly |
| 5 Insertion of biceps brachii muscle | of flexor pollicis longus muscle) |
| on radial tuberosity | 24 Flexor digitorum superficialis muscle |
| 6 Flexor digitorum superficialis muscle | 25 Flexor pollicis longus muscle (tendon) |
| (ulnar slip of humero-ulnar head, resected) | 26 Flexor digitorum superficialis muscle |
| 7 Intermuscular aponeurosis | (radial head) |
| of common head of flexor muscles | 27 Brachioradialis muscle (tendon of insertion) |
| 8 Pronator teres muscle (humeral head) | 28 Flexor digitorum superficialis muscle |
| 9 Brachial artery | (radial head, cut surface) |
| 10 Biceps brachii muscle (tendon of insertion) | 29 Flexor pollicis longus muscle |
| 11 Brachialis muscle | 30 Pronator teres muscle |
| 12 Median nerve | (humeral head, tendon of insertion) |
| 13 Brachial artery | 31 Extensor carpi radialis longus muscle |
| 14 Ulnar recurrent artery (anterior branch) | (tendon of insertion) |
| 15 Ulnar recurrent artery | 32 Radial artery with vena comitans |
| (site of division into anterior | 33 Radial nerve (superficial branch) |
| and posterior branches) | 34 Oblique cord |
| 16 Ulnar artery | 35 Common interosseous artery |
| 17 Anterior interosseous artery | 36 Radial nerve (muscular branch |
| 18 Muscle bundle | for extensor carpi radialis brevis muscle) |
| interconnecting flexor digitorum superficialis | 37 Slit in supinator muscle |
| and profundus muscles | 38 Radial recurrent artery |
| 19 Median artery | 39 Radial nerve (deep branch) |
| 20 Flexor digitorum superficialis muscle | 40 Radial nerve |
| (radial head, cut surface) | (muscular branch for supinator muscle) |
| 21 Flexor digitorum profundus muscle | 41 Lateral antebrachial cutaneous nerve |
| 22 Flexor carpi radialis muscle | |



- | | |
|--|--|
| 1 Styloid process of radius | 22 Flexor digiti minimi brevis muscle |
| 2 Abductor pollicis longus muscle
(tendon of insertion) | 23 Proper palmar digital artery
(ulnar, for little finger) |
| 3 Flexor carpi radialis muscle (tendon of insertion) | 24 Common digital nerve
(for third and ring fingers) |
| 4 Median nerve | 25 First lumbrical muscle |
| 5 Flexor digitorum superficialis tendon
for middle finger with common flexor sheath | 26 Flexor pollicis brevis muscle (superficial head) |
| 6 Flexor digitorum superficialis tendon
for ring finger with common flexor sheath | 27 Abductor pollicis brevis muscle |
| 7 Pisiform bone | 28 Tendon sheath of abductor longus
and extensor pollicis brevis muscles (cut edge) |
| 8 Vena comitans (resected) | 29 Radial artery (superficial palmar branch) |
| 9 Ulnar artery | 30 Flexor retinaculum [transverse carpal ligament]
(slip to hook of hamate bone) |
| 10 Flexor carpi ulnaris muscle | 31 Flexor retinaculum [transverse carpal ligament]
(slip to pisiform bone) |
| 11 Ulnar nerve | 32 Tendon sheath of flexor carpi radialis muscle
(cut edge) |
| 12 Ulnar artery (palmar carpal branch) | 33 Extensor pollicis brevis muscle
(tendon of insertion) |
| 13 Ulnar nerve (superficial branch) | 34 Radial artery (superficial palmar branch) |
| 14 Ulnar nerve (deep branch) | 35 Tendon sheath of abductor longus
and extensor pollicis brevis muscles (cut edge) |
| 15 Ulnar artery (deep palmar branch) | 36 Radial artery (palmar carpal branch) |
| 16 Palmar digital branch of ulnar nerve
for little finger | 37 Radial artery |
| 17 Common digital nerve
(for fourth and little fingers) | 38 Tendon sheath of flexor carpi radialis muscle
(cut edge) |
| 18 Superficial palmar arch | |
| 19 Fourth lumbrical muscle | |
| 20 Flexor digitorum superficialis tendon
for middle finger | |
| 21 Abductor digiti minimi muscle | |

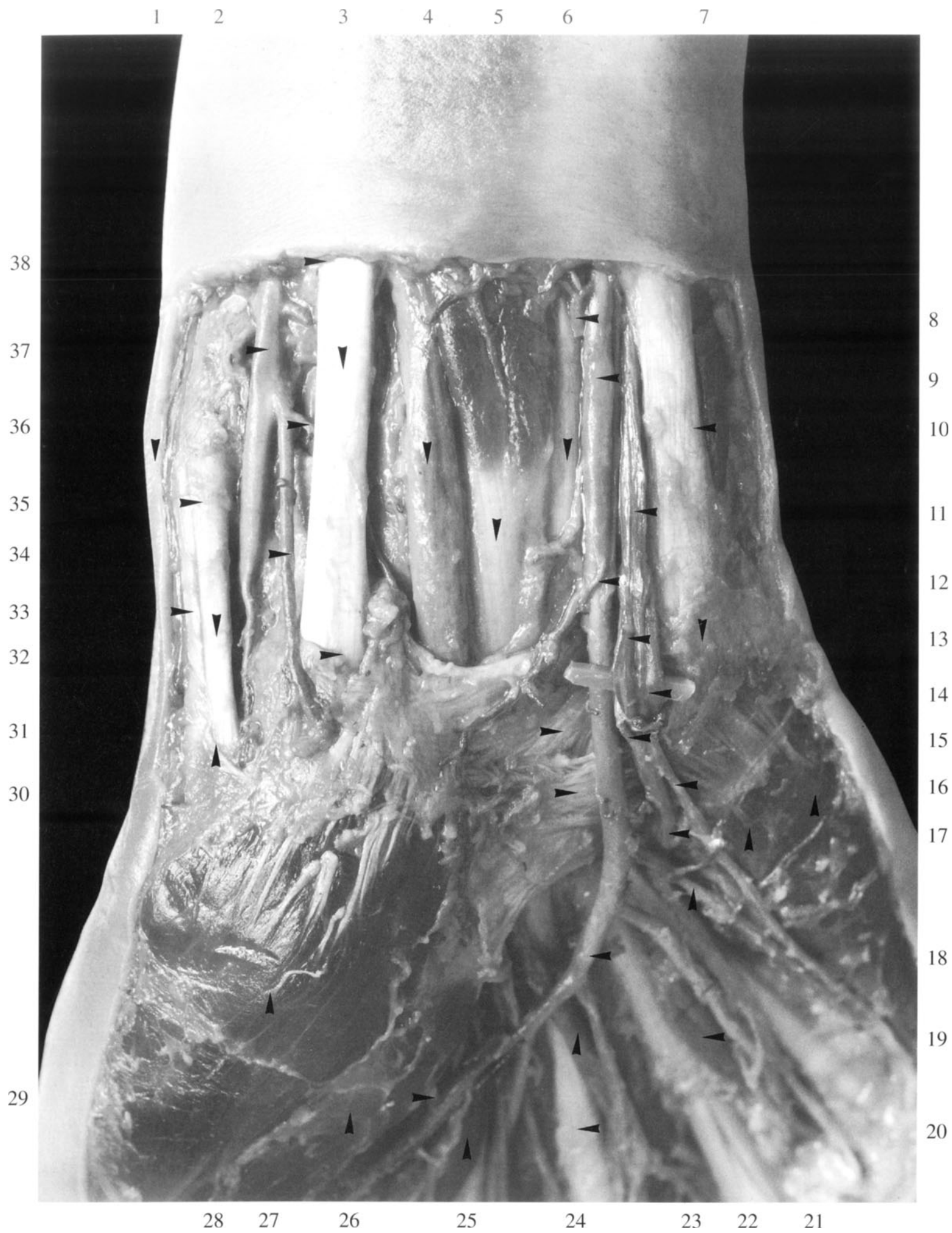


Figure 166**The Hand 1
Palm of the Hand 1
Palmar Aponeurosis 1**

- | | |
|---|--|
| 1 Subcutaneous tissue | 13 Subcutaneous tissue |
| 2 Proximal digital skin cleft | 14 Volar carpal ligament |
| 3 Monticulus | 15 Volar carpal ligament (cut edge) |
| 4 Superficial transverse metacarpal ligament | 16 Palmar fascia of hypothenar eminence |
| 5 Palmar aponeurosis (transverse fascicles) | 17 Pisiform bone with subcutaneous tissue |
| 6 Palmar aponeurosis (longitudinal fascicles) | 18 Volar carpal ligament (atypical reinforcing slip) |
| 7 Palmar aponeurosis | 19 Ulnar carpal canal |
| 8 Thenar eminence with palmar fascia
and subcutaneous tissue | 20 Palmaris brevis muscle |
| 9 Palmar fascia [superficial fascia] | 21 Palmar aponeurosis (longitudinal fascicles) |
| 10 Palmaris longus muscle (tendon) | 22 Metacarpophalangeal joint (of little finger) |
| 11 Metacarpophalangeal joint (of thumb) | 23 Palmar aponeurosis (longitudinal fascicle) |
| 12 Carpometacarpal joint (of thumb) | 24 Interdigital fold |

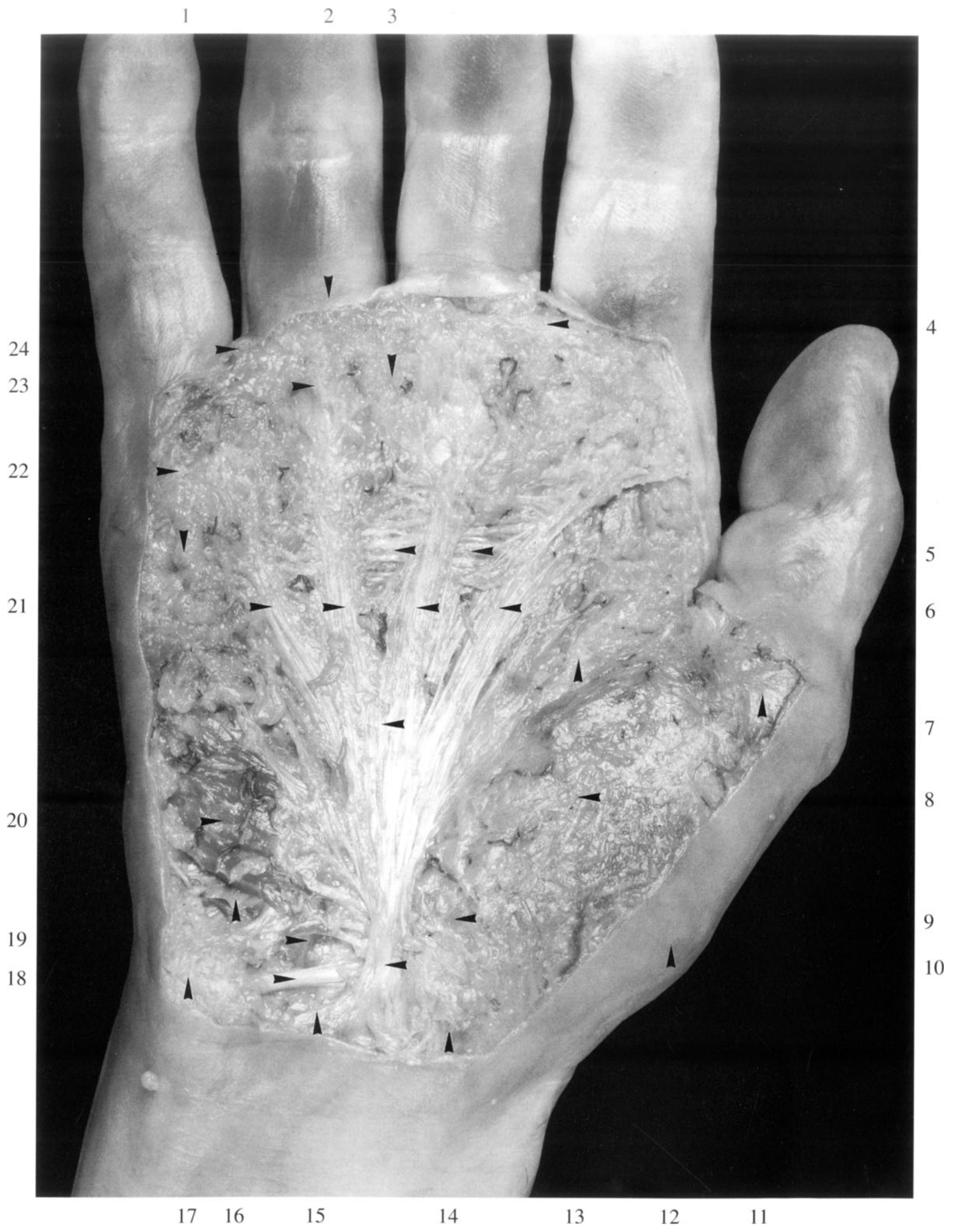
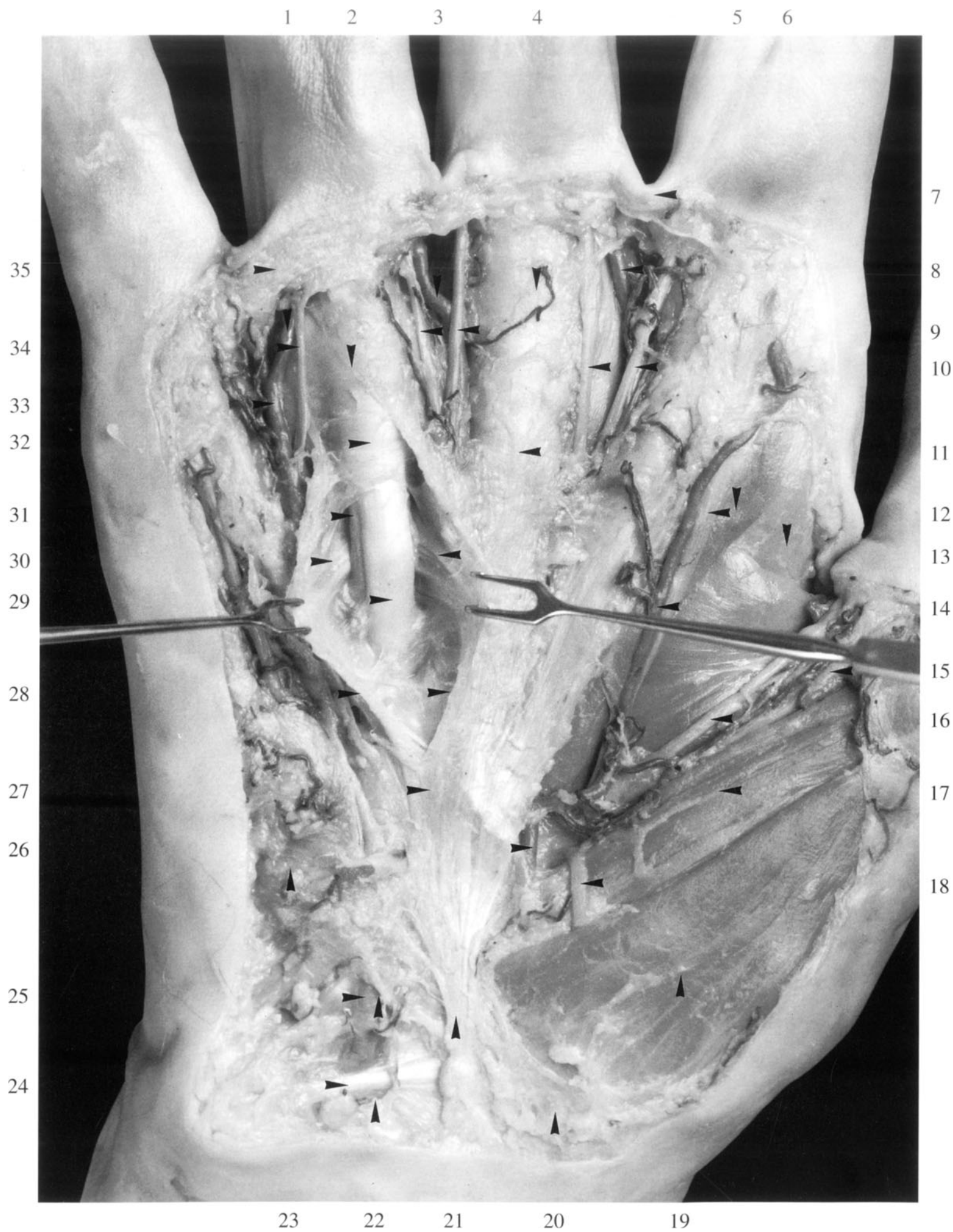


Figure 167**The Hand 2
Palm of the Hand 2
Palmar Aponeurosis 2**

- | | |
|--|--|
| 1 Proper palmar digital artery
(ulnar, for ring finger) | 18 Median nerve
(muscular branch for thenar musculature) |
| 2 Palmar aponeurosis
(longitudinal fascicle with lateral expansion) | 19 Abductor pollicis brevis muscle |
| 3 Proper palmar digital artery
(radial, for ring finger) | 20 Volar carpal ligament |
| 4 Digital tendon sheath | 21 Palmaris longus muscle (tendon) |
| 5 First lumbrical muscle | 22 Volar carpal ligament (cut edges) |
| 6 First dorsal interosseous muscle | 23 Palmaris brevis muscle |
| 7 Interdigital fold | 24 Volar carpal ligament (atypical reinforcing slip) |
| 8 Proper palmar digital artery
(radial, for middle finger) | 25 Ulnar artery in ulnar carpal canal |
| 9 Proper palmar digital nerves | 26 Radial artery
(superficial palmar branch, deeply placed) |
| 10 Proper palmar digital nerves | 27 Palmar aponeurosis |
| 11 Palmar aponeurosis
(process to digital fibrous sheath) | 28 Palmar aponeurosis
(longitudinal fascicle, cut edges) |
| 12 Proper palmar digital nerve
(radial, for index finger) | 29 Flexor digitorum superficialis tendon
for ring finger |
| 13 Palmar aponeurosis (deep expansion) | 30 Palmar aponeurosis (deep expansion) |
| 14 Radialis indicis artery | 31 Flexor digitorum profundus tendon
for ring finger |
| 15 Proper palmar digital nerve (radial, for thumb) | 32 Digital tendon sheath (proximal end) |
| 16 Proper palmar digital nerve (ulnar, for thumb) | 33 Common palmar digital artery |
| 17 Flexor pollicis brevis muscle (superficial head) | 34 Proper palmar digital nerve
(ulnar, for ring finger) |
| | 35 Superficial transverse metacarpal ligament |



The Hand 3
Palm of the Hand 3
Digital Nerves and Arteries

- | | |
|---|---|
| 1 Proper palmar digital artery
(radial, for little finger) | 20 Connecting branch
between superficial palmar arch
and princeps pollicis artery |
| 2 Palmar aponeurosis (transverse fascicles) | 21 Muscular branch of median nerve |
| 3 Palmar aponeurosis (longitudinal fascicles) | 22 Palmar aponeurosis |
| 4 Subcutaneous tissue of interdigital fold | 23 Ulnar nerve |
| 5 Subcutaneous tissue | 24 Palmaris brevis muscle |
| 6 Proper palmar digital nerve
(radial, for index finger) | 25 Abductor digiti minimi muscle
with palmar fascia |
| 7 Interdigital fold | 26 Proper palmar digital nerve
(ulnar, for little finger) |
| 8 Proper palmar digital artery
(radial, for middle finger) | 27 Ulnar artery |
| 9 Common palmar digital artery | 28 Flexor digiti minimi brevis muscle
with palmar fascia |
| 10 Proper palmar digital nerves | 29 Proper palmar digital artery
(ulnar, for little finger) |
| 11 Radialis indicis artery | 30 Proper palmar digital nerve
(ulnar, for little finger) |
| 12 First lumbrical muscle | 31 Proper palmar digital nerve
(radial, for little finger) |
| 13 Common digital nerve of thumb | 32 Proper palmar digital nerve
(radial, for ring finger) |
| 14 Flexor pollicis brevis muscle (superficial head) | 33 Common palmar digital artery |
| 15 Muscular branch of median nerve | 34 Proper palmar digital nerve
(ulnar, for middle finger) |
| 16 Abductor pollicis brevis muscle (deep part) | |
| 17 Insertion of abductor pollicis brevis muscle | |
| 18 Opponens muscle | |
| 19 Abductor pollicis brevis muscle
(superficial part) | |



Figure 169**The Hand 4
Palm of the Hand 4
Vessels and Nerves**

- | | |
|---|--|
| 1 Proper palmar digital artery
(radial, for little finger) | 20 Radial artery (palmar carpal branch) |
| 2 Fourth lumbrical muscle | 21 Opponens pollicis muscle |
| 3 Middle finger (third digit) | 22 Abductor pollicis brevis muscle |
| 4 Proper palmar digital artery
(radial, for middle finger) | 23 Muscular branch of median nerve |
| 5 First lumbrical muscle | 24 Muscular branch of median nerve |
| 6 Communicating branch
between superficial palmar arch
and princeps pollicis artery | 25 Common sheath of flexor muscles |
| 7 Common digital nerve (of thumb) | 26 Ulnar nerve (superficial branch) |
| 8 Index finger (second digit) | 27 Proper palmar digital artery
(ulnar, for little finger) |
| 9 Interdigital fold | 28 Abductor digiti minimi muscle |
| 10 Proper palmar digital nerve
(ulnar, for index finger) (dorsal branch) | 29 Ulnar artery |
| 11 Proper palmar digital nerve
(radial, for middle finger) (dorsal branch) | 30 Proper palmar digital nerve
(ulnar, for little finger) |
| 12 Proper palmar digital nerve
(radial, for index finger) | 31 Flexor digiti minimi brevis muscle |
| 13 Proper palmar digital nerves | 32 Common palmar digital artery |
| 14 Radialis indicis artery | 33 Common digital nerve of ulnar nerve |
| 15 Base of proximal phalanx of thumb
with insertion of abductor pollicis brevis muscle | 34 Common digital nerve of median nerve |
| 16 Radial artery (superficial palmar branch) | 35 Flexor digitorum superficialis tendon
for middle finger |
| 17 Flexor pollicis brevis muscle (superficial head) | 36 Common palmar digital artery |
| 18 Median nerve | 37 Proper palmar digital nerve
(radial, for little finger) |
| 19 Flexor retinaculum (transverse carpal ligament) | 38 Proper palmar digital nerve
(here branching proximal to base of digit) |
| | 39 Little finger (fifth digit) |
| | 40 Ring finger (fourth digit) |



- | | |
|--|---|
| 1 Dorsal anastomotic branch for nail bed | 20 First lumbrical muscle |
| 2 Base of distal phalanx | 21 Second lumbrical muscle |
| 3 Proper palmar digital artery
(radial, for middle finger) | 22 Superficial palmar arch |
| 4 Distal anastomotic branch
of proper palmar digital artery | 23 Proper palmar digital nerve
(ulnar, for ring finger) |
| 5 Annular part of digital fibrous sheath | 24 Proper palmar digital nerve
(radial, for little finger) |
| 6 Proper palmar digital nerve | 25 Proper palmar digital artery
(ulnar, for little finger) |
| 7 Cruciform part of digital fibrous sheath
with flexor digitorum profundus tendon | 26 Common digital nerve from ulnar nerve |
| 8 Proper palmar digital artery
(ulnar, for middle finger) | 27 Proper palmar digital nerve
(ulnar, for little finger) |
| 9 Proper palmar digital nerve
(ulnar, for middle finger) | 28 Muscular branch for second lumbrical muscle |
| 10 Annular part of digital fibrous sheath | 29 Common digital nerve from median nerve |
| 11 Proper palmar digital nerve
(radial, for middle finger) | 30 Common palmar digital artery |
| 12 Proper palmar digital nerve (dorsal branch) | 31 Proper palmar digital nerve
(radial, for middle finger) |
| 13 Proper palmar digital nerve (dorsal branch) | 32 Cruciate part of digital fibrous sheath |
| 14 Proper palmar digital nerve
(ulnar, for index finger) | 33 Proper palmar digital nerve
(ulnar, for middle finger) |
| 15 Common palmar digital artery | 34 Proper palmar digital nerve (dorsal branch) |
| 16 Communicating branch
between superficial palmar arch
and princeps pollicis artery | 35 Lamellated corpuscle [VATER-PACINI body] |
| 17 Muscular branch for first lumbrical muscle | 36 Lamellated corpuscle [VATER-PACINI body] |
| 18 Radialis indicis artery | 37 Lamellated corpuscle [VATER-PACINI body] |
| 19 Proper palmar digital nerve
(radial, for index finger) | 38 Distal anastomotic branch
of proper palmar digital artery |
| | 39 Lamellated corpuscle [VATER-PACINI body] |

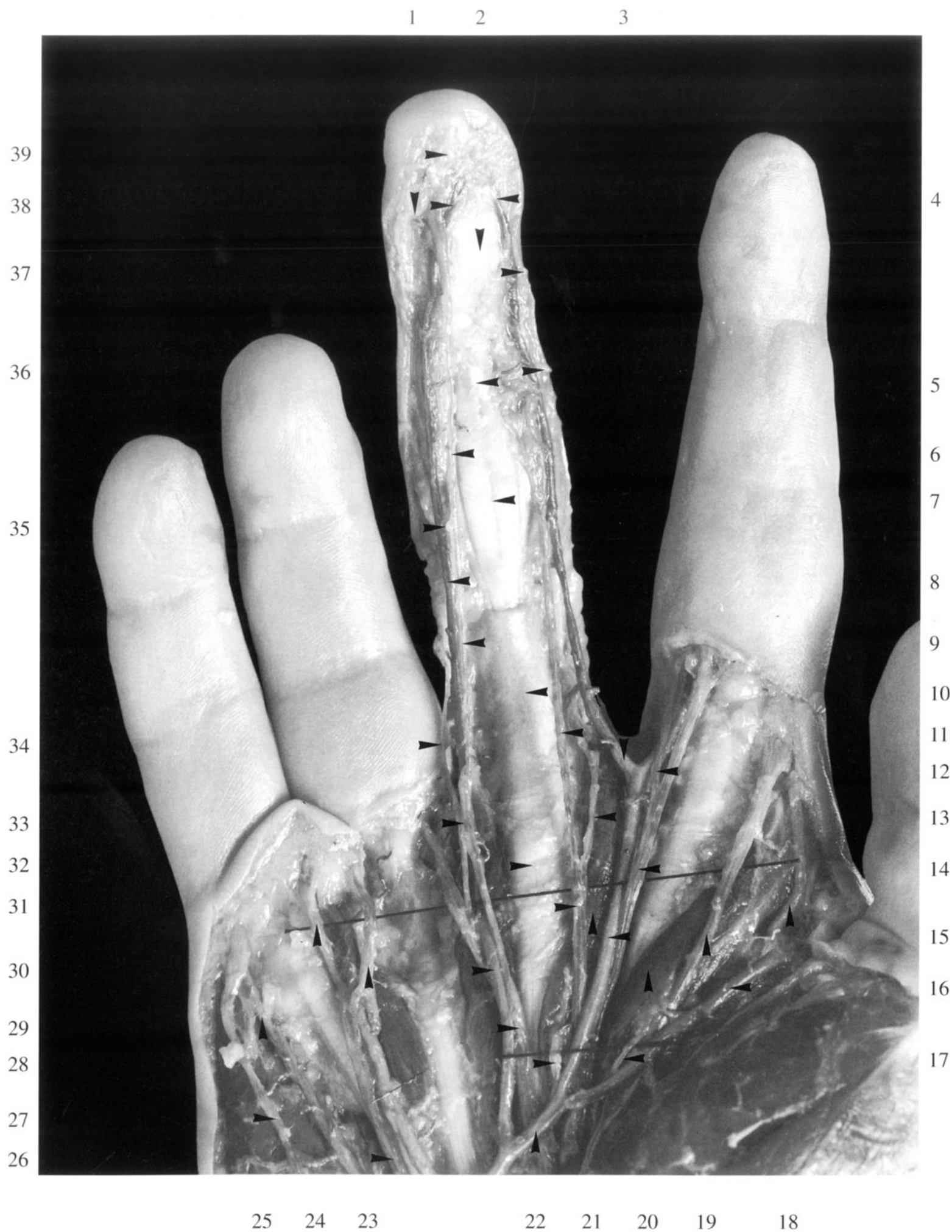


Figure 171**The Hand 6
Palm of the Hand 5
Posterior Wall of Digital Flexor Compartment**

- | | |
|---|--|
| 1 Flexor digitorum profundus tendon for ring finger | 22 Flexor digitorum superficialis muscle (radial head) |
| 2 Common palmar digital artery (cut surface) | 23 Abductor pollicis brevis muscle |
| 3 Proper palmar digital artery (ulnar, for little finger) | 24 Flexor digitorum superficialis tendon for index finger |
| 4 Flexor digitorum profundus tendon for ring finger | 25 Flexor digitorum superficialis tendon for middle finger |
| 5 Second palmar interosseous muscle | 26 Flexor digitorum superficialis tendon for ring finger |
| 6 Second lumbrical muscle | 27 Flexor digitorum superficialis tendon for little finger |
| 7 Flexor retinaculum (cut edge) | 28 Ulnar nerve |
| 8 Median nerve (muscular branch for thenar musculature) | 29 Flexor digitorum profundus tendon for little finger |
| 9 Median nerve (muscular branch for thenar musculature) | 30 Ulnar artery |
| 10 Flexor pollicis brevis muscle (superficial head) | 31 Flexor carpi ulnaris muscle |
| 11 Flexor digitorum profundus tendon for index finger | 32 Ulnar nerve (deep branch) |
| 12 Flexor pollicis longus muscle (tendon of insertion) | 33 Ulnar artery (cut surface) |
| 13 Median nerve (cut surface) | 34 Ulnar artery (deep palmar branch) |
| 14 Adductor pollicis muscle | 35 Common digital nerve from ulnar nerve |
| 15 Deep palmar arch | 36 Palmar metacarpal artery |
| 16 Ulnar nerve (deep branch) | 37 Branches for metacarpophalangeal joints and muscular branches for lumbrical muscles |
| 17 Hook of hamate bone with flexor retinaculum | 38 Proper palmar digital nerve (ulnar, for little finger) |
| 18 Capitate bone | 39 Third lumbrical muscle |
| 19 Abductor pollicis longus muscle (tendon of insertion) | 40 Flexor digitorum superficialis tendon for ring finger |
| 20 Radial artery | |
| 21 Flexor carpi radialis muscle (tendon of insertion) | |



- | | |
|---|--|
| 1 Superficial palmar arch (cut edge) | 23 Flexor digitorum superficialis tendon for ring finger |
| 2 Carpal sheath of flexor digitorum superficialis tendon to middle finger | 24 Abductor digiti minimi muscle |
| 3 Flexor digitorum profundus tendon for index finger | 25 Flexor digitorum superficialis muscle (radial head) |
| 4 Flexor digitorum superficialis tendon for index finger | 26 Flexor carpi ulnaris muscle |
| 5 Cruciform part of fibrous sheath | 27 Flexor digitorum superficialis tendon for little finger |
| 6 First lumbrical muscle | 28 Flexor pollicis longus tendon sheath (probe in proximal end) |
| 7 Adductor pollicis muscle (transverse head) | 29 Flexor digitorum superficialis tendon for middle finger, with peritendincum |
| 8 Superficial palmar arch (cut edge) | 30 Flexor digitorum superficialis tendon for little finger in common flexor sheath |
| 9 Flexor digitorum superficialis tendon for index finger | 31 Carpal intertendinous connective tissue |
| 10 Flexor digitorum profundus tendon for index finger | 32 Probe in common flexor sheath [ulnar carpal sac] (placed along flexor digitorum profundus tendon for little finger) |
| 11 Probe in carpal sheath of tendon for index finger | 33 Common flexor sheath [ulnar carpal sac] (cut edge of opening) |
| 12 Mesotendineum of radial carpal sac | 34 Probe in common flexor sheath [ulnar carpal sac] (placed along flexor digitorum superficialis tendon for little finger, connects with digital tendon sheath of little finger) |
| 13 Flexor pollicis longus tendon sheath [radial carpal sac] (cut edge) | 35 Flexor digiti minimi brevis muscle |
| 14 Abductor pollicis longus muscle (tendon of insertion) | 36 Fourth lumbrical muscle |
| 15 Flexor carpi radialis muscle (tendon of insertion) | 37 Cruciform part of fibrous sheath |
| 16 Radial artery | 38 Flexor digitorum profundus tendon for ring finger |
| 17 Abductor pollicis brevis muscle | 39 Annular part of fibrous sheath |
| 18 Flexor pollicis brevis muscle (superficial head) | |
| 19 Extensor pollicis brevis muscle (tendon of insertion) | |
| 20 Flexor retinaculum | |
| 21 Flexor pollicis longus muscle | |
| 22 Flexor digitorum profundus tendon for index finger | |



- | | |
|--|--|
| 1 Hypothenar with palmar fascia | 21 Probe in common flexor sheath |
| 2 Tendon artery of deep palmar arch | 22 Flexor digitorum superficialis tendon for middle finger |
| 3 Digital tendon sheath of little finger (cut edge) | 23 Common flexor sheath [ulnar carpal sac] (cut edge of opening) |
| 4 Median nerve (cut surface) | 24 Tendon artery from ulnar artery |
| 5 Muscular branch of median nerve for thenar musculature | 25 Flexor carpi ulnaris muscle |
| 6 Adductor pollicis muscle (transverse head) | 26 Flexor digitorum profundus tendon for little finger |
| 7 Cruciform part of fibrous sheath | 27 Flexor digitorum superficialis tendon for little finger |
| 8 First lumbrical muscle | 28 Probe in common flexor sheath |
| 9 Flexor digitorum superficialis tendon for middle finger | 29 Ulnar nerve |
| 10 Flexor digitorum profundus tendon for middle finger | 30 Common flexor sheath [ulnar carpal sac] (cut edge of opening) |
| 11 Flexor digitorum superficialis tendon for ring finger | 31 Probe in common flexor sheath along flexor digitorum profundus tendon for little finger |
| 12 Probe in common flexor sheath and digital tendon sheath of little finger | 32 Common flexor sheath [ulnar carpal sac] (posterior wall) |
| 13 Probe in common flexor sheath in front of mesotendineum of superficial tendon for little finger | 33 Flexor retinaculum (cut edge) |
| 14 Flexor digitorum superficialis tendon for ring finger | 34 Common flexor sheath (cut edge of posterior wall) |
| 15 Abductor pollicis longus muscle (tendon of insertion) | 35 Flexor digitorum superficialis tendon for little finger |
| 16 Radial artery | 36 Flexor digitorum profundus tendon for little finger |
| 17 Flexor carpi radialis muscle (tendon of insertion) | 37 Deep palmar fascia |
| 18 Abductor pollicis brevis muscle | 38 Cruciform part of fibrous sheath |
| 19 Flexor pollicis brevis muscle | |
| 20 Extensor pollicis brevis muscle (tendon of insertion) | |



- | | |
|---|---|
| 1 Flexor digitorum profundus muscle
(tendon of insertion for index finger) | 16 Common palmar digital artery |
| 2 Periosteum of distal phalanx | 17 Cruciform part of fibrous sheath |
| 3 Digital tendon sheath (distal end) | 18 Fourth lumbrical muscle |
| 4 Flexor digitorum profundus muscle
(tendon of insertion) | 19 Third lumbrical muscle |
| 5 Flexor digitorum superficialis muscle
(tendon of insertion, ulnar slip) | 20 Flexor digitorum superficialis tendon
for middle finger |
| 6 Tendinous chiasm | 21 Second lumbrical muscle |
| 7 Flexor digitorum superficialis muscle
(tendon of insertion, radial slip) | 22 Proper palmar digital nerve
(radial, for ring finger) |
| 8 Annular part of fibrous sheath (cut edge) | 23 Proper palmar digital nerve (dorsal branch) |
| 9 Cruciform part of fibrous sheath (cut edge) | 24 Proper palmar digital artery |
| 10 Cruciform part of fibrous sheath | 25 Annular part of fibrous sheath |
| 11 Digital tendon sheath (proximal end) | 26 Proper palmar digital nerves |
| 12 First lumbrical muscle | 27 Proper palmar digital artery |
| 13 Muscular branch to first lumbrical muscle | 28 Cruciform part of fibrous sheath |
| 14 Flexor pollicis brevis muscle (superficial head) | 29 Annular part of fibrous sheath
(on middle phalanx) |
| 15 Vessel connecting superficial palmar arch
with princeps pollicis artery | 30 Cruciform part of fibrous sheath |



- 1 Flexor digitorum profundus tendon for ring finger
- 2 Vinculum breve of flexor digitorum superficialis muscle
- 3 Annular part of fibrous sheath (cut edge)
- 4 Annular part of fibrous sheath
- 5 Cruciform part of fibrous sheath
- 6 Flexor digitorum profundus tendon for index finger
- 7 Flexor digitorum superficialis tendon for index finger (ulnar slip)
- 8 Annular part of fibrous sheath
- 9 Vaginal ligament
- 10 Proper palmar digital artery (radial, for middle finger)
- 11 Common palmar digital artery
- 12 Cruciform part of fibrous sheath
- 13 Proper palmar digital nerves
- 14 First dorsal interosseous muscle
- 15 First lumbrical muscle
- 16 Flexor pollicis brevis muscle (superficial head)
- 17 Muscular branch to first lumbrical muscle
- 18 Superficial palmar arch
- 19 Third lumbrical muscle
- 20 Vinculum longum of flexor digitorum superficialis muscle (insertion)
- 21 Flexor digiti minimi brevis muscle
- 22 Muscular branch to second lumbrical muscle
- 23 Third lumbrical muscle
- 24 Digital tendon sheath (cut edge)
- 25 Tendinous chiasm
- 26 Flexor digitorum superficialis tendon for ring finger (radial slip)
- 27 Vinculum longum of flexor digitorum profundus muscle
- 28 Flexor digitorum superficialis muscle (cruciform fiber exchange between two slips of tendon for ring finger)
- 29 Flexor digitorum superficialis tendon for ring finger
- 30 Vinculum breve of flexor digitorum profundus muscle
- 31 Proper palmar digital nerve (ulnar, for middle finger)
- 32 Proper palmar digital artery (ulnar, for middle finger)

1

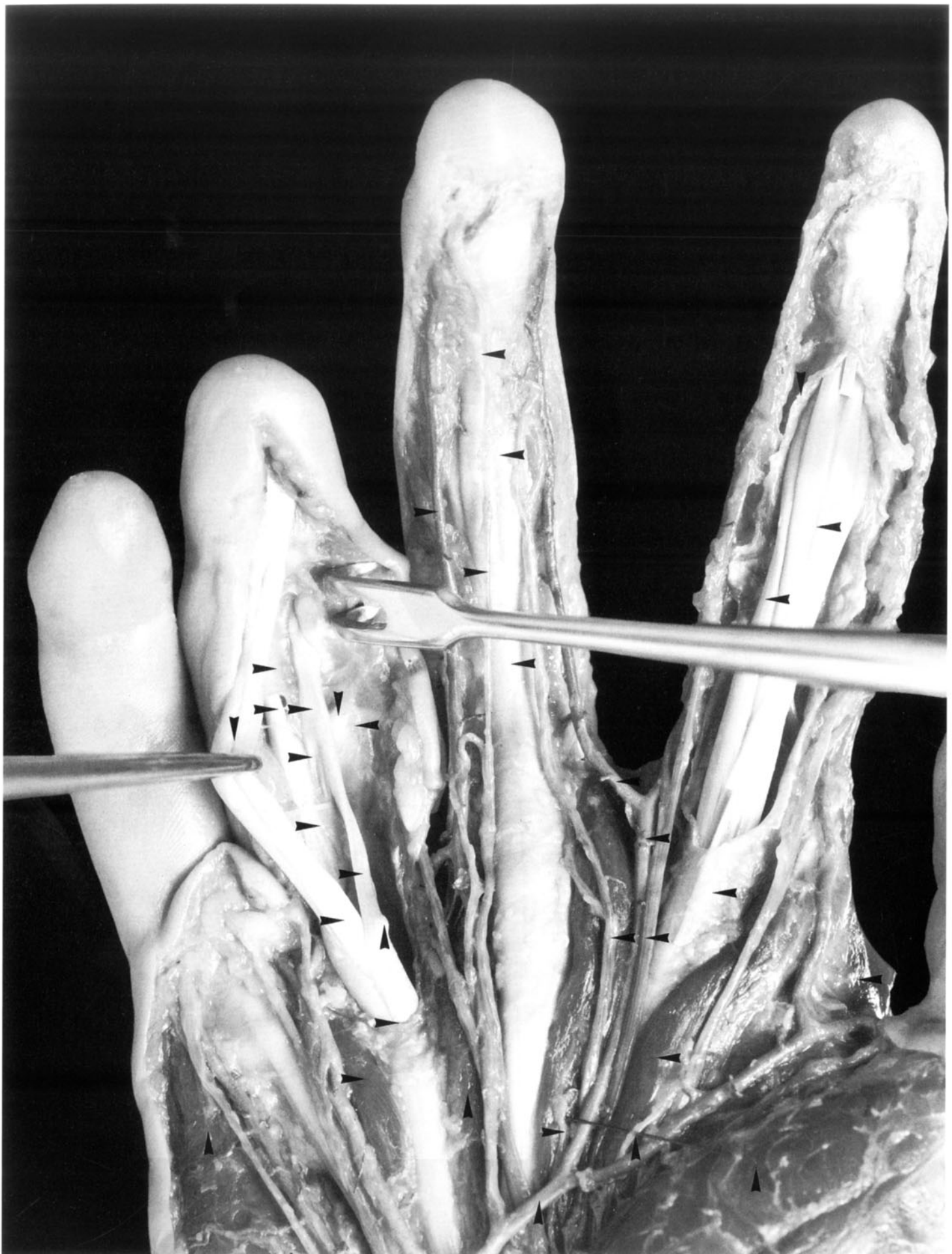
2

3

32
31
30
29
28
27
26
25
24
23
22

4
5
6
7
8
9
10
11
12
13
14
15

21 20 19 18 17 16



- | | | | |
|----|--|----|--|
| 1 | Distal flexion crease of finger | 16 | Flexor digitorum superficialis tendon for index finger |
| 2 | Flexor digitorum profundus muscle (tendon of insertion) | 17 | Flexor digitorum profundus tendon for index finger |
| 3 | Middle flexion crease of finger | 18 | Second lumbrical muscle (origin on profundus tendons) |
| 4 | Annular part of fibrous sheath of proximal phalanx (distal end) | 19 | Head of metacarpal |
| 5 | Cruciform part of fibrous sheath of proximal interphalangeal joint | 20 | Flexor digitorum superficialis tendon for little finger |
| 6 | Annular part of fibrous sheath of metacarpophalangeal joint | 21 | Third lumbrical muscle (origin on profundus tendons) |
| 7 | Annular part of fibrous sheath of metacarpophalangeal joint (proximal end) | 22 | Flexor digitorum profundus tendon for ring finger |
| 8 | Second lumbrical muscle | 23 | Flexor digitorum superficialis tendon for ring finger |
| 9 | First lumbrical muscle | 24 | Metacarpophalangeal joint capsule (cut edge) |
| 10 | Flexor digitorum superficialis tendon for middle finger | 25 | Palmar ligament of metacarpophalangeal joint of ring finger |
| 11 | Flexor digitorum superficialis tendon for index finger | 26 | Cruciform part of fibrous sheath (cut edge) |
| 12 | Flexor digitorum profundus tendon for middle finger | 27 | Digital synovial sheath |
| 13 | Flexor digitorum superficialis tendon for index finger | 28 | Tendinous chiasm |
| 14 | Flexor retinaculum [transverse carpal ligament] (cut edge) | 29 | Palmar ligament of proximal interphalangeal joint |
| 15 | Probe in carpal tendon sheath for tendons to index finger | 30 | Flexor digitorum superficialis muscle (tendon of insertion, radial slip) |
| | | 31 | Flexor digitorum profundus muscle (tendon of insertion) |



The Hand 12

Dorsal Tendon Sheath Compartments

- | | | | |
|----|---|----|---|
| 1 | Abductor digiti minimi muscle | 22 | Extensor pollicis brevis muscle |
| 2 | Intertendinous connection | 23 | Abductor pollicis longus muscle |
| 3 | Fourth dorsal interosseous muscle
with deep dorsal fascia of hand | 24 | Dorsal tubercle of radius |
| 4 | Intertendinous connection (scant) | 25 | Extensor digitorum tendon for index finger |
| 5 | Third metacarpal bone | 26 | Extensor carpi ulnaris muscle
(tendon of insertion) |
| 6 | Second metacarpal bone | 27 | Ulna (styloid process) |
| 7 | Extensor pollicis longus muscle
(tendon of insertion) | 28 | Extensor digitorum muscle |
| 8 | Head of second metacarpal bone | 29 | Extensor digiti minimi muscle |
| 9 | Extensor indicis muscle (tendon of insertion) | 30 | Ulna (posterior surface) |
| 10 | Extensor digitorum tendon for index finger | 31 | Sheath for extensor carpi ulnaris tendon |
| 11 | First dorsal interosseous muscle | 32 | Sheath for extensor carpi ulnaris tendon |
| 12 | Extensor digitorum tendons for middle finger | 33 | Sheath for radial carpal extensor tendons
(divided along
extensor carpi radialis brevis tendon) |
| 13 | Second dorsal interosseous muscle | 34 | Sheath for extensor digiti minimi tendon |
| 14 | Base of second metacarpal bone | 35 | Extensor digiti minimi muscle
(tendon of insertion) |
| 15 | Sheath for tendons of extensor digitorum
and extensor indicis muscles | 36 | Extensor digitorum tendon
(division with extension to little finger) |
| 16 | Sheath for radial carpal extensor tendons
(divided along
extensor carpi radialis longus tendon) | 37 | Extensor digitorum muscle
(tendons of insertion) |
| 17 | Sheath for extensor pollicis longus tendon | 38 | Head of fifth metacarpal bone |
| 18 | Extensor retinaculum [dorsal carpal ligament] | 39 | Extensor digitorum muscle
(site where divided tendons reconverge) |
| 19 | Sheath for extensor pollicis longus tendon | | |
| 20 | Sheath for radial carpal extensor tendons | | |
| 21 | Radius (posterior surface) | | |

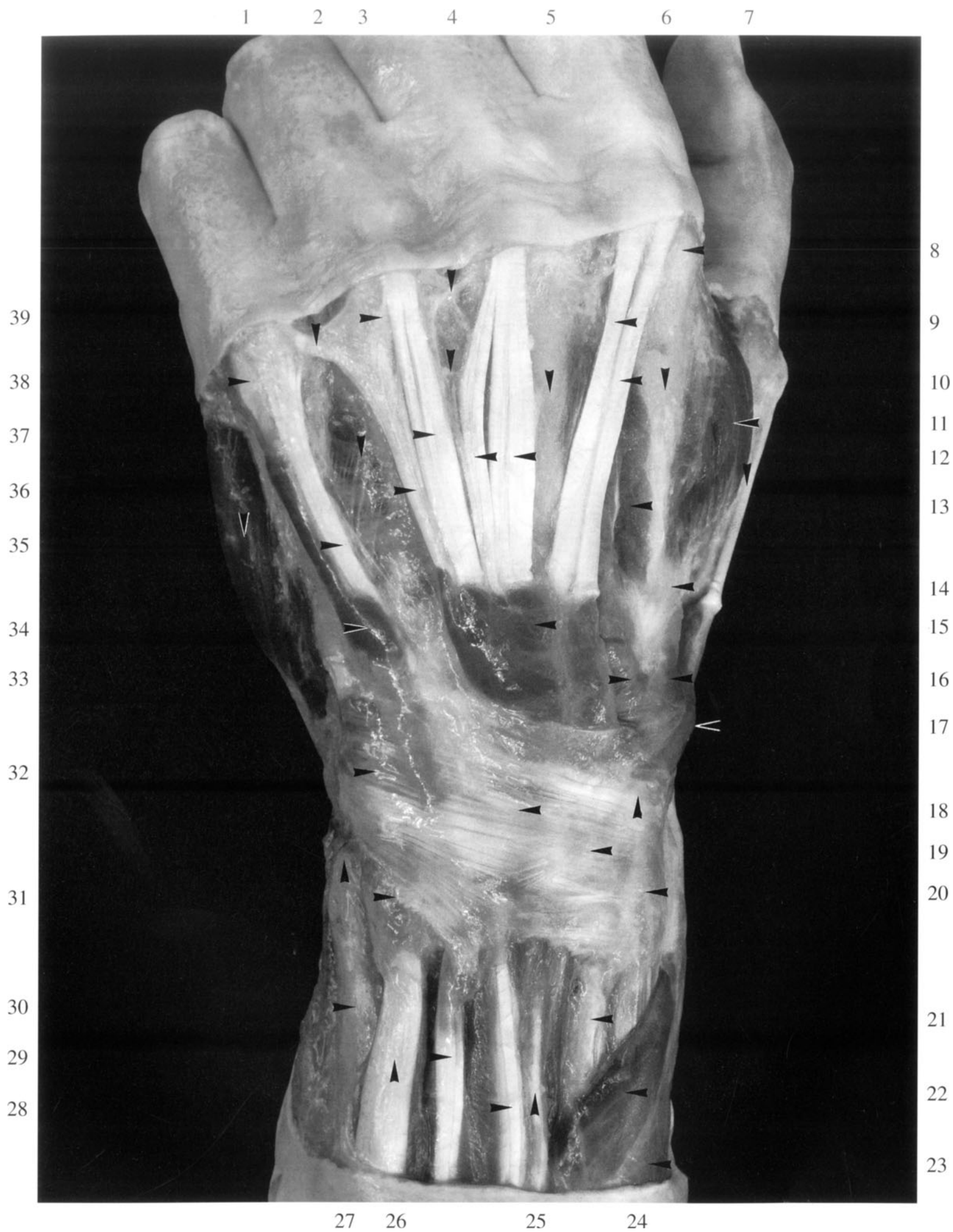


Figure 178

**Posterior Antebrachial Region 1
Superficial Layer 1**

- | | |
|--|---|
| 1 Fat pad in opened flat tunnel transmitting cephalic vein | 9 Deep layer of stratum subcutaneum |
| 2 Connective tissue layer between antebrachial fascia and deep layer of stratum subcutaneum | 10 Lateral epicondyle of humerus |
| 3 Extensor digiti minimi muscle | 11 Deep layer of stratum subcutaneum |
| 4 Antebrachial fascia | 12 Subcutaneous tissue (cut surface) |
| 5 Extensor digiti minimi muscle | 13 Intermuscular aponeurotic septum between extensor carpi radialis brevis muscle and extensor digitorum muscle |
| 6 Intermuscular aponeurotic septum between extensor carpi ulnaris muscle and extensor digiti minimi muscle | 14 Extensor digitorum muscle |
| 7 Extensor carpi ulnaris muscle | 15 Extensor carpi radialis brevis muscle |
| 8 Extensor digitorum muscle with fascia supplementing skeletal origin | 16 Cephalic vein |
| | 17 Abductor pollicis longus muscle |
| | 18 Cephalic vein |
| | 19 Abductor pollicis longus muscle |
| | 20 Extensor digitorum muscle (tendon of insertion) |

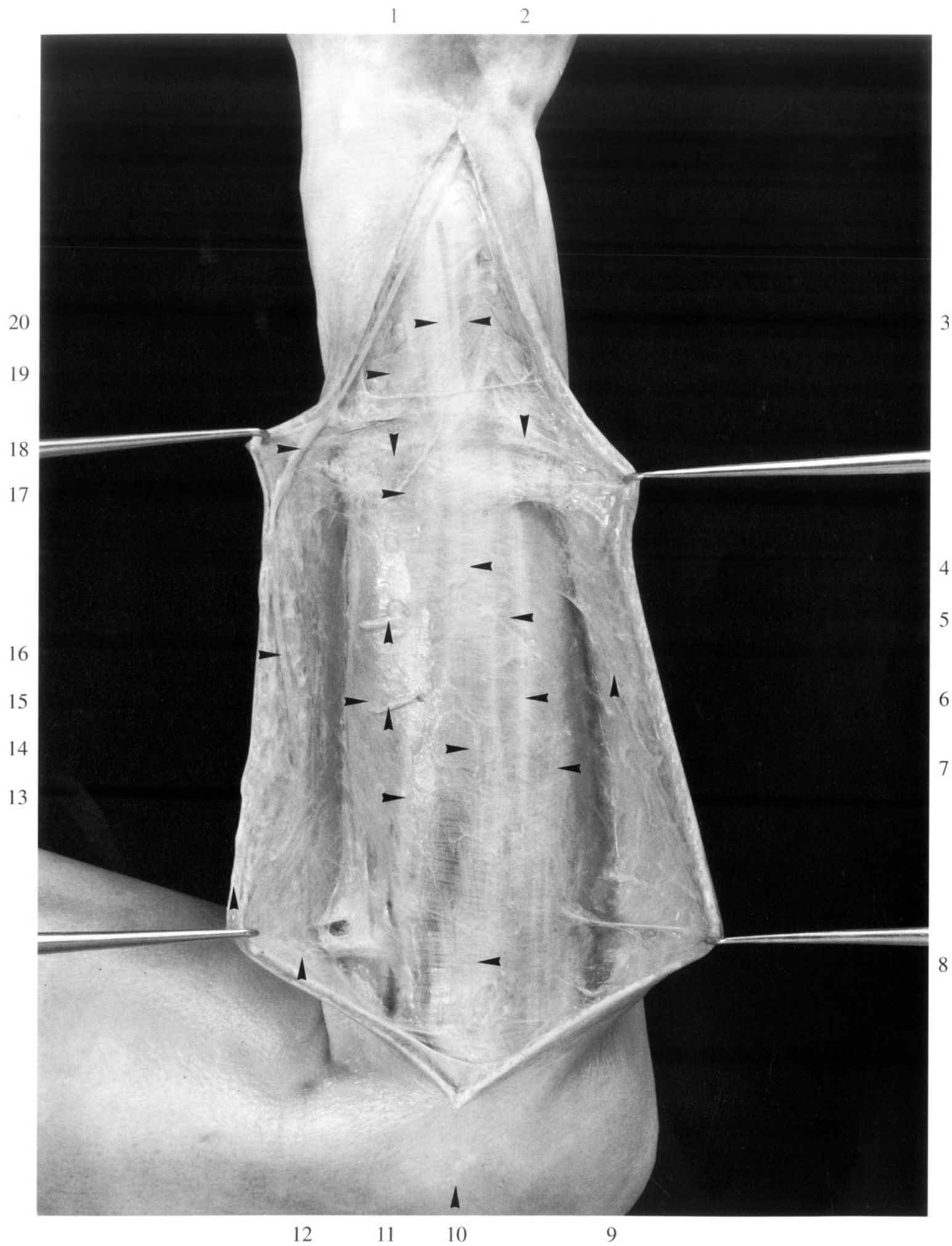


Figure 179

Posterior Antebrachial Region 2
Superficial Layer 2

- | | | | |
|----|--|----|---|
| 1 | Extensor indicis muscle | 12 | Intermuscular aponeurotic septum |
| 2 | Extensor pollicis longus muscle | | between extensor carpi radialis brevis muscle |
| 3 | Extensor digitorum muscle | | and extensor digitorum muscle |
| 4 | Extensor digiti minimi muscle | 13 | Deep layer of stratum subcutaneum |
| 5 | Antebrachial fascia (cut edge) | 14 | Intermuscular aponeurotic septum |
| 6 | Deep layer of stratum subcutaneum | | between extensor carpi radialis brevis muscle |
| 7 | Extensor digitorum muscle | | and extensor digitorum muscle |
| 8 | Extensor carpi ulnaris muscle | 15 | Cephalic vein |
| 9 | Extensor digitorum muscle | 16 | Antebrachial fascia (cut edge) |
| | with fascia supplementing skeletal origins | 17 | Abductor pollicis longus muscle |
| 10 | Lateral epicondyle of humerus | 18 | Perforating branch |
| 11 | Extensor carpi radialis brevis muscle | | of anterior interosseous artery |
| | | 19 | Extensor pollicis brevis muscle |
| | | 20 | Radius (posterior surface) |

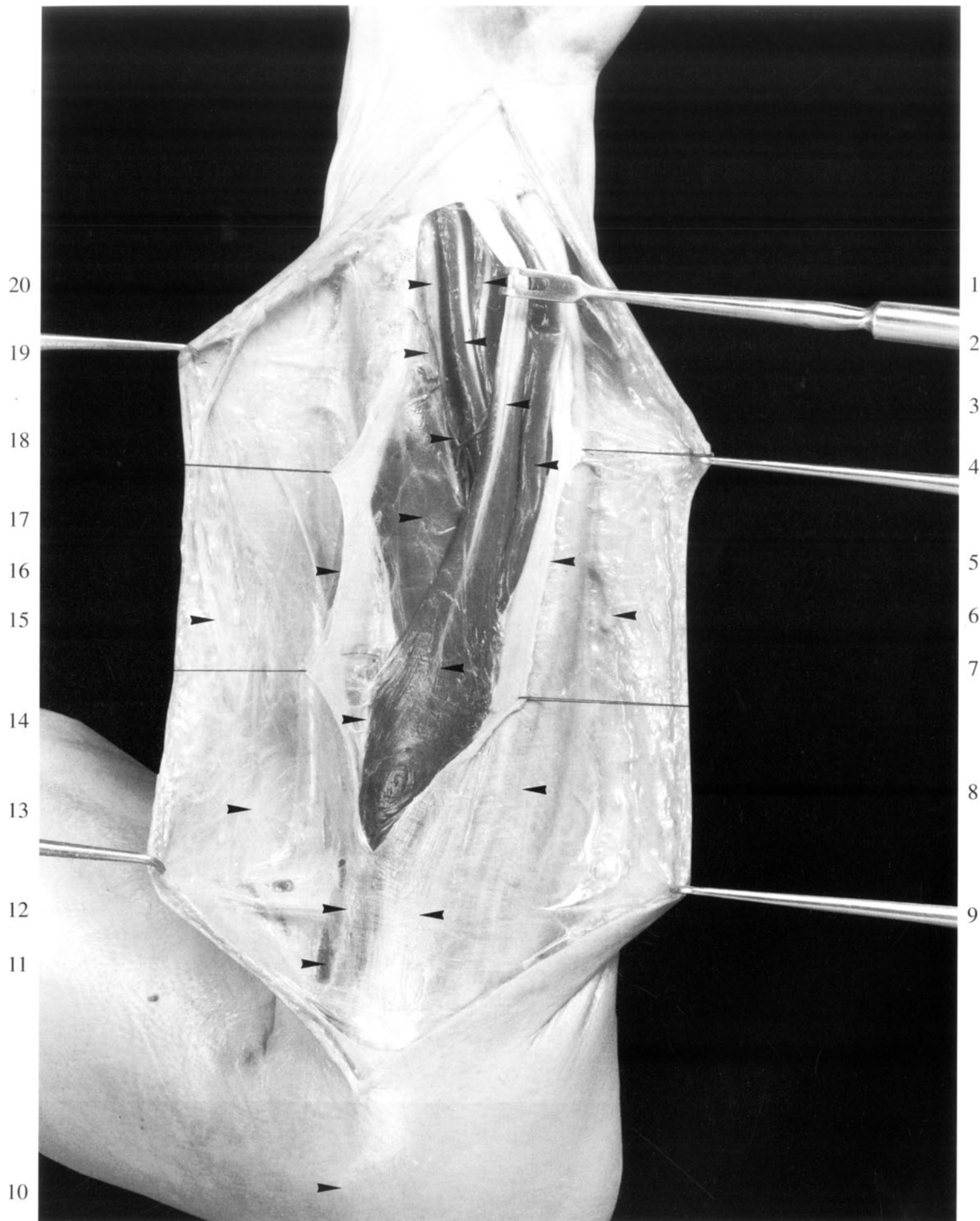


Figure 180**Posterior Antebrachial Region 3
Deep Layer 1**

- | | | | |
|----|---|----|--|
| 1 | Deep layer of stratum subcutaneum | 20 | Intermuscular aponeurotic septum
(between extensor digitorum
and extensor carpi radialis brevis muscles,
cut surface) |
| 2 | Abductor pollicis longus muscle
with antebrachial fascia | 21 | Lateral epicondyle of humerus |
| 3 | Muscular branch to extensor indicis muscle | 22 | Intermuscular aponeurotic septum
(between extensor digitorum
and extensor carpi radialis brevis muscles,
cut surface) |
| 4 | Extensor digiti minimi muscle
(tendon of insertion covered by dorsal fascia) | 23 | Intermuscular aponeurotic septum
(between extensor digitorum
and extensor carpi radialis brevis muscles) |
| 5 | Fifth metacarpal bone | 24 | Extensor carpi radialis longus muscle |
| 6 | Antebrachial fascia | 25 | Extensor carpi radialis brevis muscle |
| 7 | Extensor carpi ulnaris muscle
(tendon of insertion) | 26 | Supinator muscle (deep layer) |
| 8 | Extensor pollicis longus muscle | 27 | Supinator muscle (superficial layer) |
| 9 | Extensor indicis muscle | 28 | Abductor pollicis longus muscle |
| 10 | Interosseous membrane | 29 | Posterior antebrachial cutaneous nerve |
| 11 | Extensor digitorum muscle | 30 | Anterior interosseous artery
[(proximal) perforating branch] |
| 12 | Extensor pollicis longus muscle | 31 | Posterior interosseous nerve |
| 13 | Muscular branch to abductor pollicis longus
and extensor pollicis brevis muscles | 32 | Antebrachial fascia (cut edge) |
| 14 | Muscular branch
to extensor pollicis longus muscle | 33 | Radius (posterior surface) |
| 15 | Radial nerve (deep branch) | 34 | Extensor pollicis brevis muscle |
| 16 | Extensor digitorum muscle
(fascia supplementing skeletal origin) | 35 | Extensor retinaculum [dorsal carpal ligament] |
| 17 | Extensor carpi ulnaris muscle | 36 | Extensor digitorum muscle
(tendon of insertion covered by dorsal fascia) |
| 18 | Deep layer of stratum subcutaneum | | |
| 19 | Posterior interosseous artery | | |

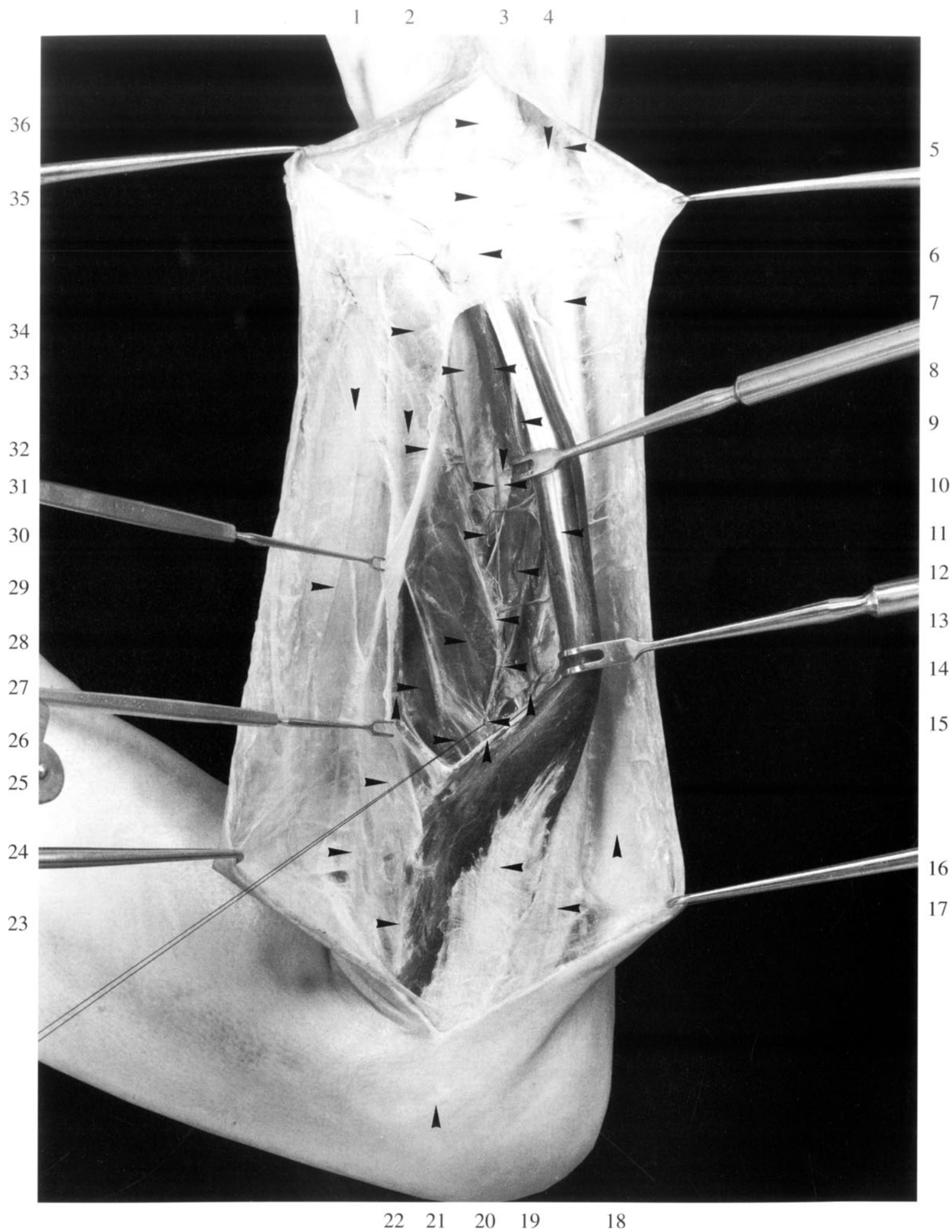
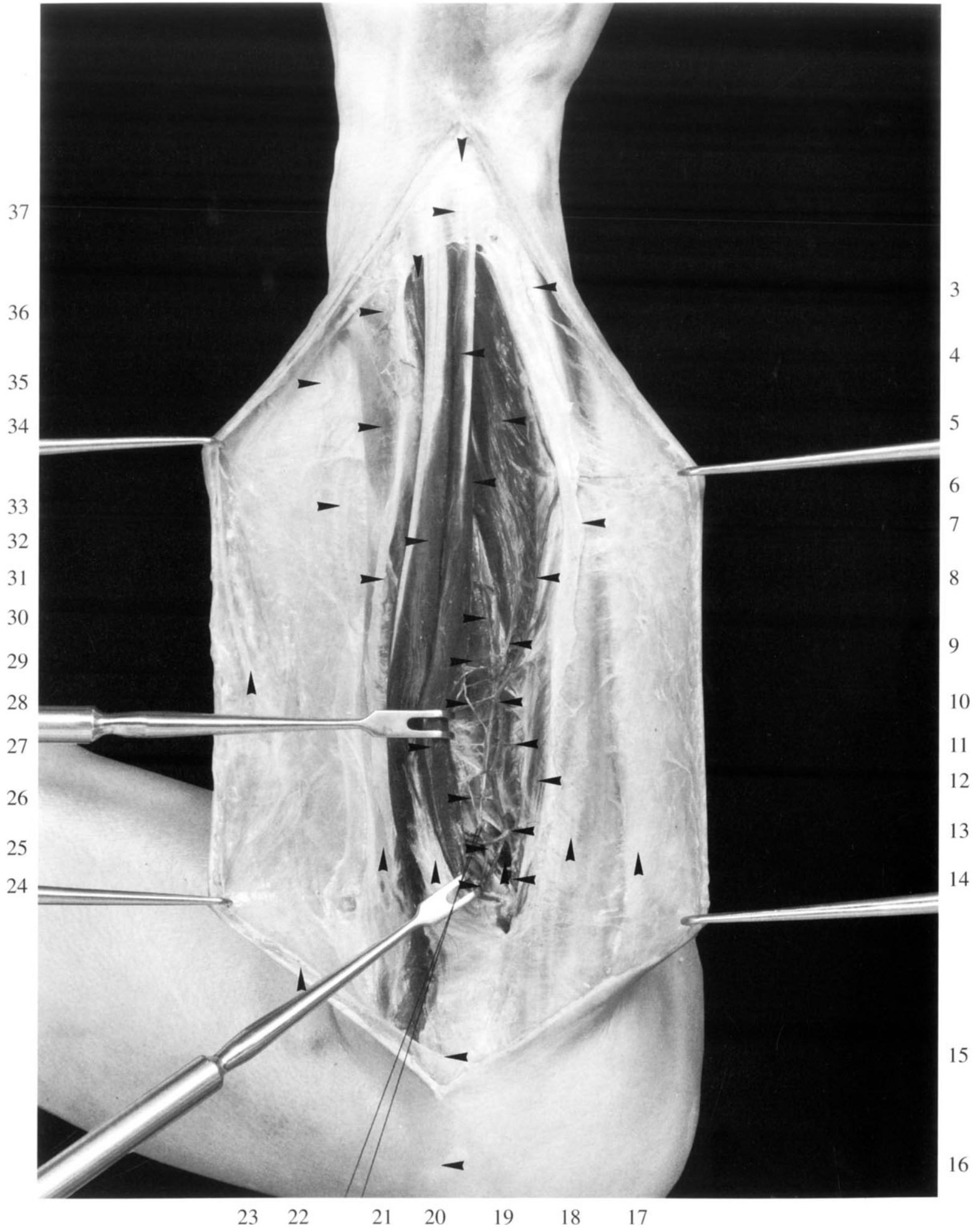


Figure 181 **Posterior Antebrachial Region 4**
Deep Layer 2

- | | |
|---|---|
| 1 Extensor pollicis longus muscle | 19 Supinator muscle (deep layer) |
| 2 Extensor retinaculum [dorsal carpal ligament] | 20 Extensor digitorum muscle |
| 3 Extensor carpi ulnaris muscle | (fascia supplementing skeletal origin, aponeurosis) |
| 4 Extensor digiti minimi muscle | 21 Extensor carpi radialis brevis muscle |
| 5 Extensor indicis muscle | 22 Subcutaneous tissue (cut surface) |
| 6 Extensor pollicis longus muscle | 23 Cephalic vein (dorsal route) |
| 7 Antebrachial fascia (cut edge) | 24 Muscular branch to extensor digitorum muscle |
| 8 Anastomotic branch | 25 Radial nerve |
| from posterior interosseous artery | (deep branch emerging from supinator muscle) |
| to anterior interosseous artery | 26 Muscular branch to extensor digitorum muscle |
| 9 Muscular branch | 27 Extensor digiti minimi muscle |
| to extensor pollicis longus muscle | 28 Muscular branch |
| 10 Posterior interosseous artery | to extensor digiti minimi muscle |
| 11 Extensor pollicis longus muscle | 29 Abductor pollicis longus muscle |
| 12 Intermuscular aponeurotic septum | 30 Muscular branch to abductor pollicis longus |
| (between extensor carpi ulnaris | and extensor pollicis brevis muscles |
| and extensor digiti minimi muscles) | 31 Antebrachial fascia (cut edge) |
| 13 Posterior interosseous artery | 32 Extensor digitorum muscle |
| (entrance into extensor compartment | 33 Median antebrachial vein |
| at distal border of supinator muscle) | or volar route of cephalic vein |
| 14 Recurrent interosseous artery | 34 Abductor pollicis longus muscle |
| 15 Deep layer of stratum subcutaneum (cut edge) | 35 Deep layer of stratum subcutaneum |
| 16 Lateral epicondyle of humerus | 36 Extensor pollicis brevis muscle |
| 17 Deep layer of stratum subcutaneum | 37 Antebrachial fascia |
| 18 Extensor carpi ulnaris muscle | |



- 1 First dorsal interosseous muscle
- 2 Extensor carpi radialis longus muscle
(tendon of insertion)
- 3 Extensor carpi radialis brevis muscle
(tendon of insertion)
- 4 Extensor digitorum tendon for index finger
- 5 Extensor digitorum tendon for middle finger
- 6 Dorsal digital aponeurosis
- 7 Extensor indicis muscle (tendon of insertion)
- 8 Extensor digitorum tendon for ring finger
- 9 Extensor digiti minimi muscle
(tendon of insertion)
- 10 Sheath for extensor digiti minimi tendon
- 11 Sheath for extensor digitorum
and extensor indicis tendons
- 12 Sheath for extensor carpi ulnaris tendon
- 13 Sheath for extensor digiti minimi tendon
- 14 Sheath for extensor digiti minimi tendon
- 15 Extensor digiti minimi muscle
- 16 Extensor digitorum muscle
- 17 Extensor carpi ulnaris muscle
- 18 Extensor retinaculum [dorsal carpal ligament]
- 19 Abductor pollicis longus muscle
- 20 Radial nerve (superficial branch)
- 21 Extensor pollicis brevis muscle
- 22 Sheath for extensor pollicis longus tendon
- 23 Sheath for tendons of extensores carpi radiales
- 24 Sheath for extensor pollicis longus tendon
- 25 Sheath for tendons of extensores carpi radiales
- 26 Sheath for extensor pollicis longus tendon
- 27 Extensor pollicis longus muscle



- | | |
|--|---|
| 1 Proximal interphalangeal joint | 12 Dorsal interosseous muscle |
| 2 Nail fold | (tendon of insertion) |
| 3 Middle phalanx (base) | 13 Dorsal digital expansion (marginal slip) |
| 4 Dorsal digital expansion (intermediate slip) | 14 Expansion from marginal slip |
| 5 Dorsal digital expansion (marginal slip) | of dorsal digital expansion |
| 6 Dorsal digital expansion (collateral slip) | 15 Dorsal digital expansion |
| 7 Dorsal digital expansion (triangular ligament) | (transverse retinaculum) |
| 8 Extensor digitorum tendon | 16 Distal retinaculum of dorsal digital expansion |
| 9 Proximal retinaculum of dorsal digital expansion | 17 Dorsal digital expansion (collateral slip) |
| 10 Metacarpophalangeal joint | 18 Distal interphalangeal joint |
| 11 Head of metacarpal bone, | 19 Distal phalanx |
| covered by joint capsule and triangular ligament | (base with attachment |
| of dorsal digital expansion | of united collateral and marginal slips) |



- | | | | |
|----|--|----|---|
| 1 | Intertubercular sulcus | 17 | Scapula (lateral border) |
| 2 | Greater tuberosity of humerus | 18 | Inferior angle of scapula |
| 3 | Anatomic neck of humerus | 19 | Scapula (costal surface) |
| 4 | Acromioclavicular joint | 20 | Neck of scapula
with attachment of fibrous joint capsule |
| 5 | Superior glenohumeral ligament | 21 | Biceps brachii muscle
(tendon of origin of long head) |
| 6 | Glenoid cavity of scapula | 22 | Shaft of humerus |
| 7 | Coracoclavicular ligament (trapezoid ligament) | 23 | Crest of lesser tuberosity |
| 8 | Clavicle (acromial end) | 24 | Surgical neck of humerus |
| 9 | Body of clavicle | 25 | Lesser tuberosity of humerus |
| 10 | Scapula (medial border) | 26 | Biceps brachii muscle
(tendon of origin of long head) |
| 11 | Coracoacromial ligament | 27 | Scapular spine |
| 12 | Coracohumeral ligament | 28 | Acromion (palpable bony prominence) |
| 13 | Coracoid process (palpable bony prominence) | | |
| 14 | Middle glenohumeral ligament | | |
| 15 | Inferior glenohumeral ligament | | |
| 16 | Infraglenoid tubercle of scapula | | |



- | | | | |
|----|---|----|--|
| 1 | Crest of greater tuberosity | 20 | Greater tuberosity of humerus |
| 2 | Crest of lesser tuberosity | 21 | Joint capsule (cut edge) |
| 3 | Mesotendineum (variant) | 22 | Surgical neck of humerus |
| 4 | Lesser tuberosity of humerus | 23 | Mesotendineum (variant) |
| 5 | Mesotendineum (variant) | 24 | Anatomic neck of humerus |
| 6 | Head of humerus | 25 | Head of humerus |
| 7 | Biceps brachii muscle (tendon of long head) | 26 | Inferior glenohumeral ligament |
| 8 | Middle glenohumeral ligament | 27 | Glenoid cavity |
| 9 | Supraglenoid tubercle | 28 | Junction of scapular spine with acromion
(cut surface) |
| 10 | Coracoacromial ligament (cut surface) | 29 | Superior transverse scapular ligament |
| 11 | Supraspinous fossa of scapula | 30 | Scapula (costal surface) |
| 12 | Spine of scapula | 31 | Infraglenoid tubercle |
| 13 | Coracohumeral ligament (cut surface) | 32 | Glenoid labrum with fibrous joint capsule |
| 14 | Coracoclavicular ligament
(trapezoid ligament, cut surface) | 33 | Neck of scapula |
| 15 | Superior glenohumeral ligament | 34 | Supraglenoid tubercle |
| 16 | Coracohumeral ligament (cut surface) | 35 | Coracohumeral ligament
(cut edge of origin on coracoid process) |
| 17 | Coracoid process (horizontal ramus) | 36 | Scapula (superior border) |
| 18 | Biceps brachii muscle
(tendon of long head with synovial membrane) | 37 | Intertubercular tendon sheath (distal end) |
| 19 | Middle glenohumeral ligament | 38 | Greater tuberosity of humerus |

1 2 3 4 5 6 7 8 9 10 11

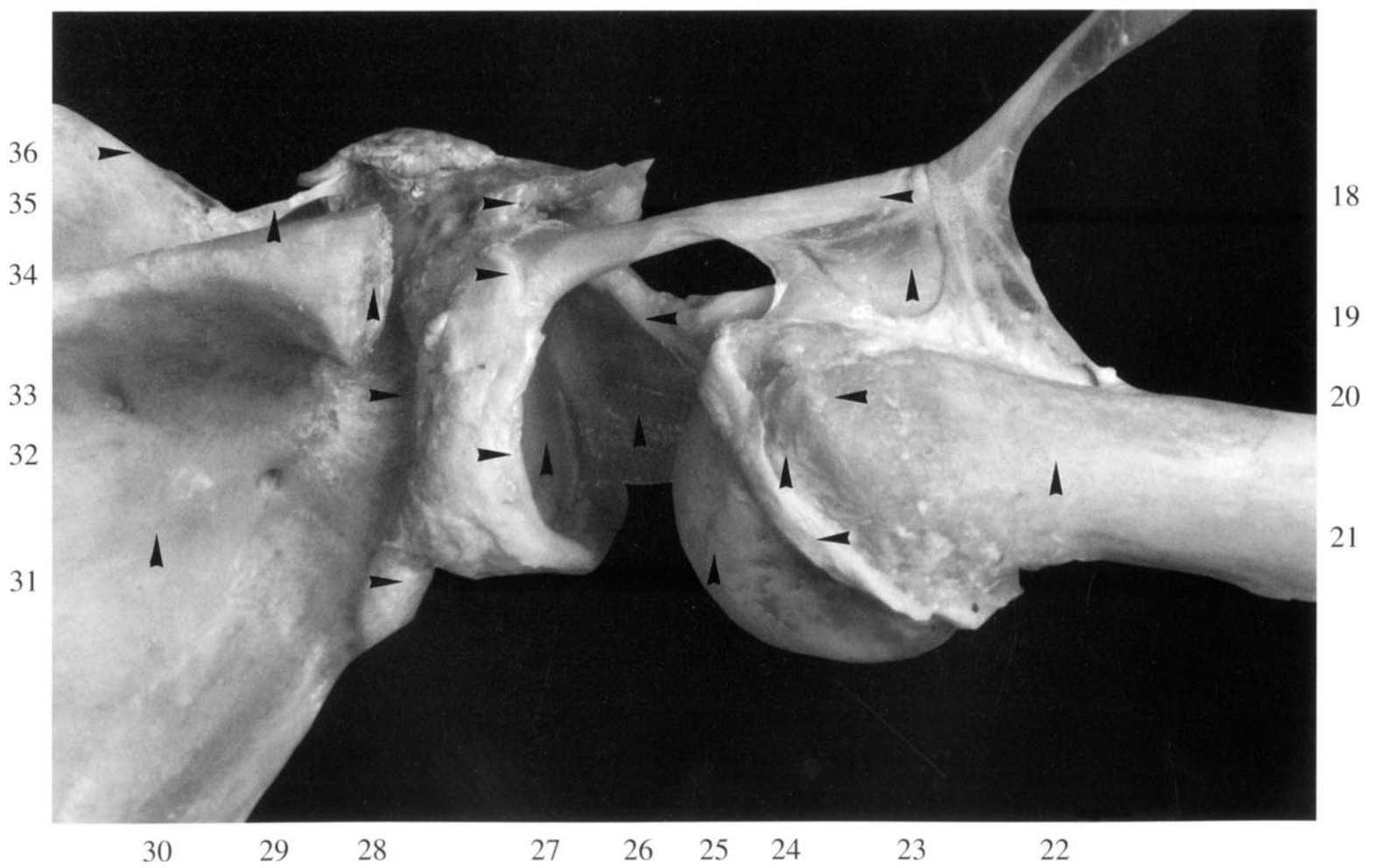
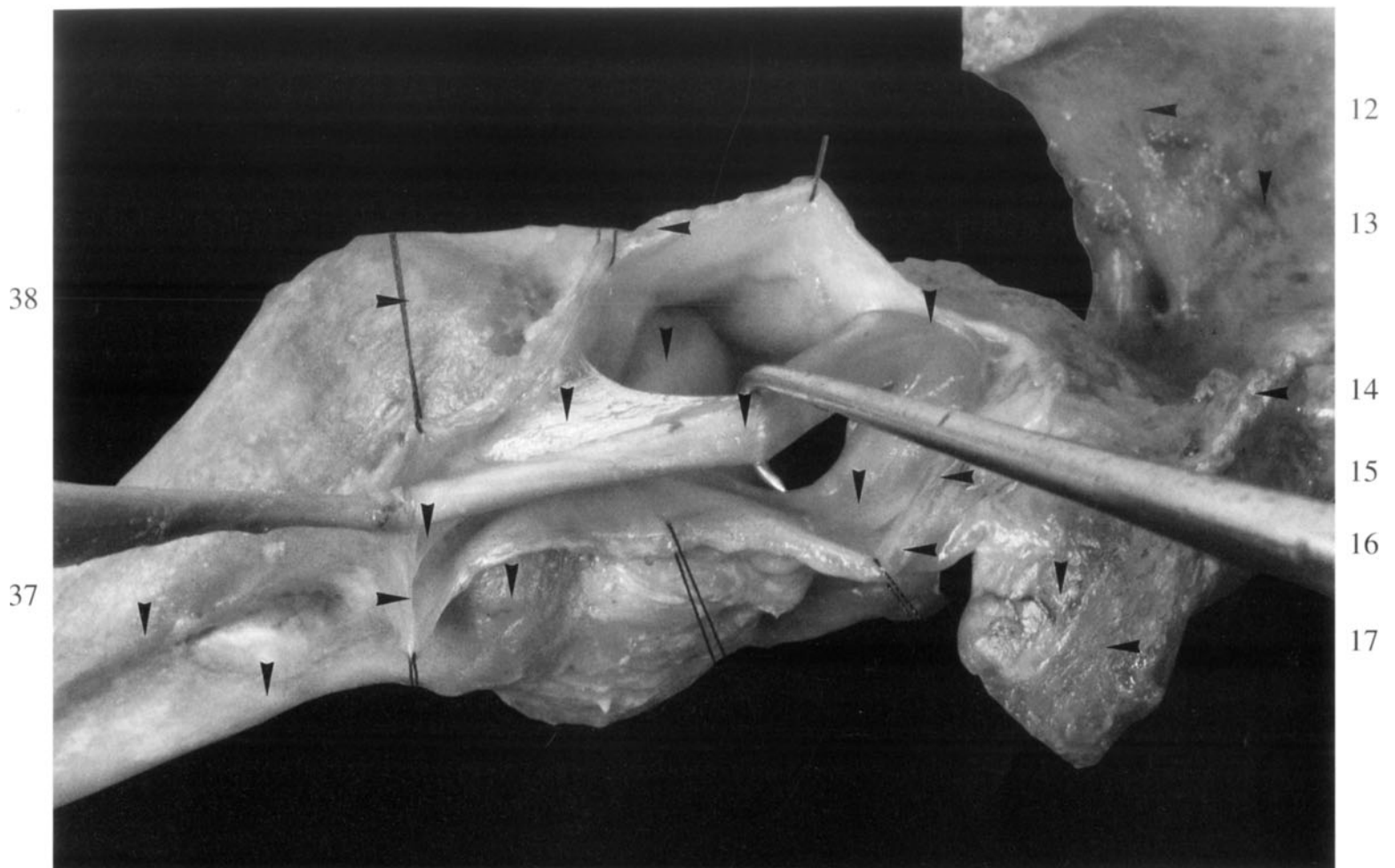


Figure 186

**Shoulder Joint 3
Deformation of the Joint Capsule
with Arm Movements**

- | | | | |
|----|--|----|---------------------------------------|
| 1 | Acromion | 19 | Lesser tuberosity of humerus |
| 2 | Folds in dependent part of joint capsule (axillary recess) | 20 | Greater tuberosity of humerus |
| 3 | Joint capsule (part stretched over humeral head) | 21 | Joint capsule (crumpled) |
| 4 | Greater tuberosity of humerus | 22 | Neck of scapula |
| 5 | Spine of scapula | 23 | Spine of scapula |
| 6 | Infraglenoid tubercle | 24 | Anatomic neck of humerus |
| 7 | Fold from lax upper part of capsule (in abduction) | 25 | Joint capsule (stretched) |
| 8 | Joint capsule (part stretched over humeral head) | 26 | Coracohumeral ligament |
| 9 | Surgical neck of humerus | 27 | Scapula (medial border) |
| 10 | Clavicle | 28 | Infraglenoid tubercle |
| 11 | Acromion | 29 | Neck of scapula |
| 12 | Greater tuberosity of humerus | 30 | Inferior transverse scapular ligament |
| 13 | Inferior transverse scapular ligament | 31 | Acromial angle |
| 14 | Acromioclavicular ligament | 32 | Scapula (medial border) |
| 15 | Acromion | 33 | Shaft of humerus |
| 16 | Inferior transverse scapular ligament | 34 | Infraglenoid tubercle |
| 17 | Crest of greater tuberosity | 35 | Neck of scapula |
| 18 | Biceps brachii muscle (tendon of long head) | 36 | Inferior transverse scapular ligament |
| | | 37 | Clavicle |

1 2 3 4

37

36

35

34

33

32



5 6 7 8 9

10

11

12

13



31

30

29

28

27



26

25

24

14

15

16

17



23

22

21

20

19

18

Figure 187

**Shoulder Joint 4
Anterior Puncture**

- | | | | |
|----|---|----|---------------------------------------|
| 1 | Body of clavicle | 13 | Surgical neck of humerus |
| 2 | Coracoclavicular ligament (conoid ligament) | 14 | Shaft of humerus |
| 3 | Coracoclavicular ligament (trapezoid ligament) | 15 | Crest of lesser tuberosity |
| 4 | Clavicle (acromial end) | 16 | Anatomic neck of humerus |
| 5 | Coracoacromial ligament | 17 | Middle glenohumeral ligament |
| 6 | Superior glenohumeral ligament | 18 | Neck of scapula |
| 7 | Acromion | 19 | Scapula (costal surface) |
| 8 | Acromioclavicular joint
(acromioclavicular ligament) | 20 | Scapula (medial border) |
| 9 | Spine of scapula | 21 | Infraglenoid tubercle |
| 10 | Coracohumeral ligament | 22 | Anterior puncture of shoulder joint |
| 11 | Head of humerus | 23 | Coracoid process (horizontal ramus) |
| 12 | Lesser tuberosity of humerus | 24 | Superior transverse scapular ligament |
| | | 25 | Scapula (superior border) |



Figure 188

**Shoulder Joint 5
Posterior Puncture**

- | | | | |
|----|---|----|---------------------------------------|
| 1 | Body of clavicle | 11 | Shaft of humerus |
| 2 | Coracoclavicular ligament (conoid ligament) | 12 | Biceps brachii muscle (long head) |
| 3 | Coracoclavicular ligament (trapezoid ligament) | 13 | Surgical neck of humerus |
| 4 | Clavicle (acromial end) | 14 | Infraspinous fossa of scapula |
| 5 | Posterior puncture of shoulder joint | 15 | Scapula (lateral border) |
| 6 | Acromial angle | 16 | Infraglenoid tubercle |
| 7 | Acromioclavicular joint
(acromioclavicular ligament) | 17 | Neck of scapula |
| 8 | Acromion | 18 | Spine of scapula |
| 9 | Head of humerus with joint capsule | 19 | Supraspinous fossa of scapula |
| 10 | Intertubercular tendon sheath | 20 | Superior transverse scapular ligament |
| | | 21 | Scapula (superior border) |

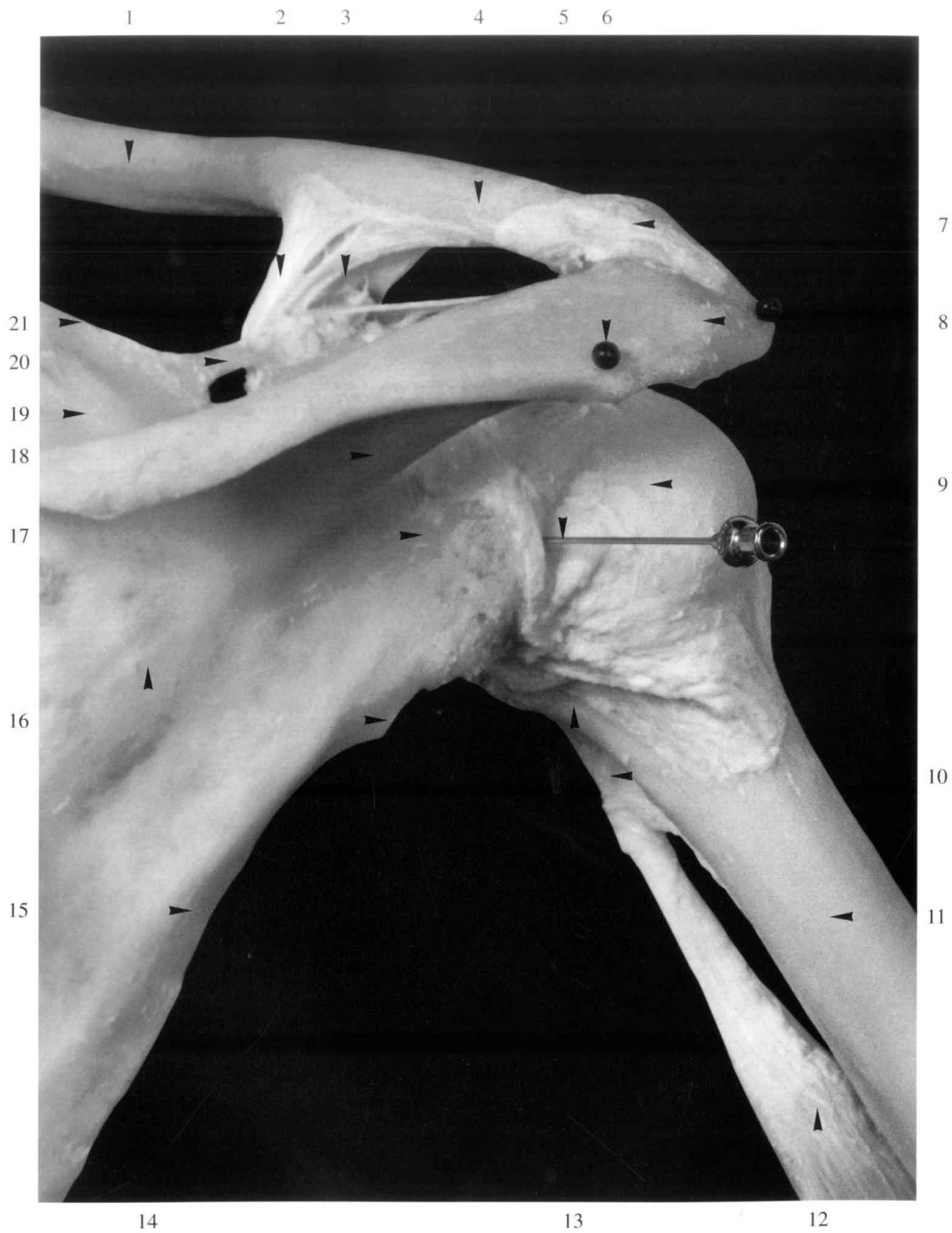


Figure 189 Elbow Joint 1

- | | | | |
|----|----------------------------------|----|----------------------------------|
| 1 | Lateral epicondyle | 12 | Nutrient foramen |
| 2 | Capitulum of humerus | 13 | Coronoid process |
| 3 | Humerus (anterolateral surface) | 14 | Quadrangle ligament |
| 4 | Joint capsule (fibrous membrane) | 15 | Radial collateral ligament |
| 5 | Humerus (anteromedial surface) | 16 | Radius (anterior surface) |
| 6 | Trochlea of humerus | 17 | Radial tuberosity |
| 7 | Ulnar collateral ligament | 18 | Neck of radius |
| 8 | Medial epicondyle | 19 | Sacciform recess |
| 9 | Medial supracondylar crest | 20 | Annular ligament |
| 10 | Ulnar tuberosity | 21 | Head of radius (proximal border) |
| 11 | Ulna (anterior surface) | 22 | Lateral supracondylar crest |



- | | | | |
|---|--|----|--|
| 1 | Medial epicondyle (of humerus) | 10 | Radial collateral ligament |
| 2 | Ulnar collateral ligament (posterior band) | 11 | Sacciform recess |
| 3 | Humerus (posterior surface) | 12 | Ulna (posterior surface and olecranon) |
| 4 | Lateral epicondyle (of humerus) | 13 | Ulna (medial surface) |
| 5 | Lateral supracondylar crest | 14 | Ulna (posterior border) |
| 6 | Olecranon fossa | 15 | Trochlear notch of ulna |
| 7 | Trochlear notch of ulna | 16 | Capsular pad of olecranon fossa |
| 8 | Subcutaneous area of ulna | 17 | Medial supracondylar crest |
| 9 | Radial notch of ulna | | |

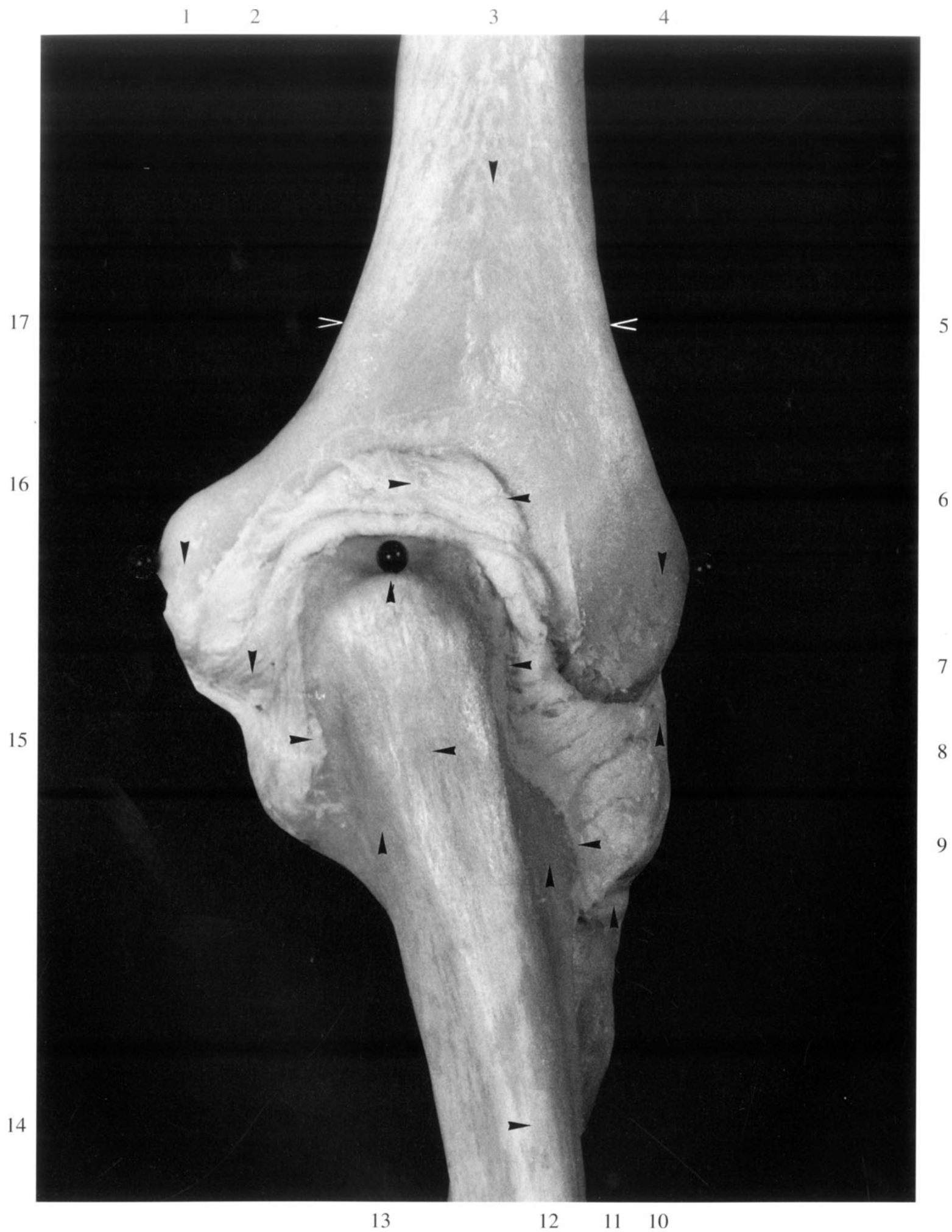


Figure 191**Elbow Joint 3
Collateral Ligaments
Interosseous Membrane**

- | | | | |
|----|--|----|---|
| 1 | Ulna (anterior border) | 19 | Interosseous membrane |
| 2 | Oblique cord | 20 | Ulna (interosseous border) |
| 3 | Radial tuberosity | 21 | Ulna (posterior surface) |
| 4 | Neck of radius | 22 | Oblique cord |
| 5 | Coronoid process | 23 | Supinator crest |
| 6 | Ulnar collateral ligament (anterior band) | 24 | Annular ligament |
| 7 | Ulnar collateral ligament (posterior band) | 25 | Radial collateral ligament (posterior part) |
| 8 | Medial epicondyle of humerus | 26 | Trochlear notch of ulna |
| 9 | Humerus (anteromedial surface) | 27 | Olecranon |
| 10 | Capitulum of humerus | 28 | Lateral supracondylar crest |
| 11 | Trochlea of humerus | 29 | Radial notch of ulna |
| 12 | Ulnar tuberosity | 30 | Lateral epicondyle of humerus |
| 13 | Oblique ligament of COOPER | 31 | Radial collateral ligament (anterior part) |
| 14 | Olecranon | 32 | Humerus (medial surface) |
| 15 | Shaft of radius | 33 | Ulna (medial surface) |
| 16 | Sacciform recess | 34 | Interosseous membrane |
| 17 | Ulna (posterior surface) | 35 | Radius (anterior border) |
| 18 | Ulna (posterior border) | | |

1 2 3 4 5 6 7 8 9

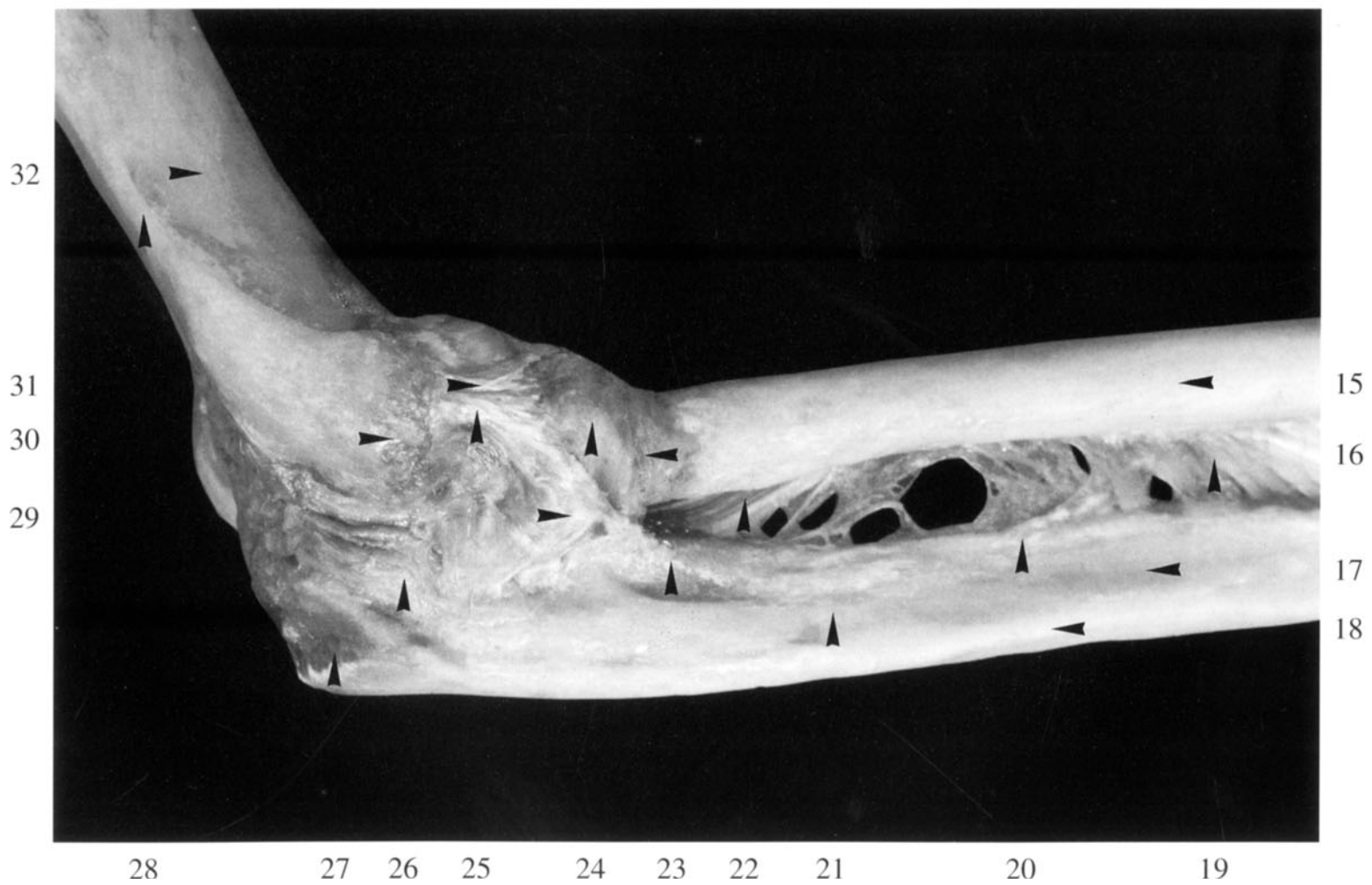
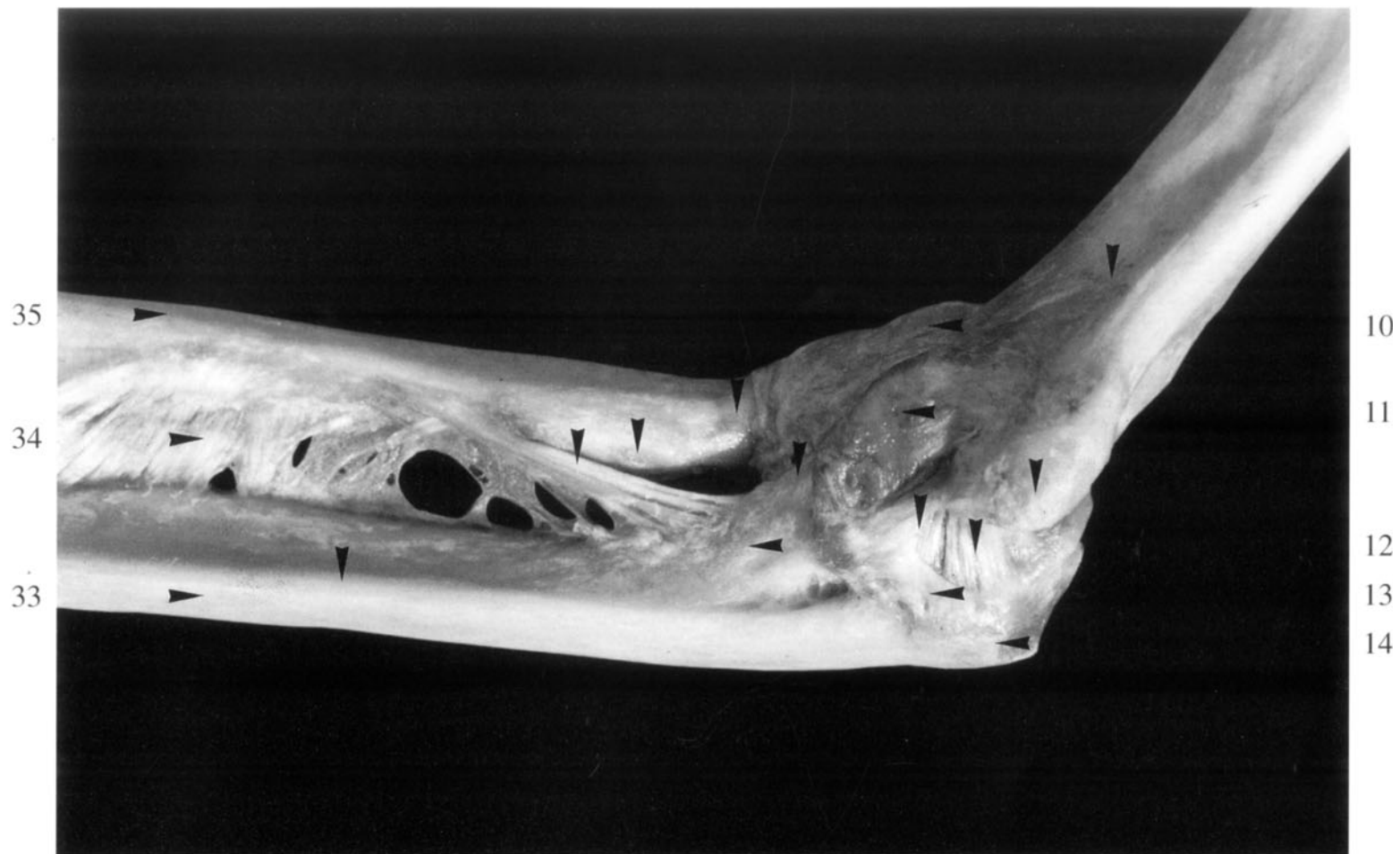


Figure 192

Elbow Joint 4
Function of the Ulnar Collateral Ligament

- | | | | |
|----|--|----|---|
| 1 | Ulna (interosseous border) | 18 | Oblique ligament of COOPER |
| 2 | Ulna (anterior border) | 19 | Humerus (posterior surface) |
| 3 | Ulna (posterior border) | 20 | Olecranon |
| 4 | Oblique cord | 21 | Ulnar collateral ligament (anterior band) |
| 5 | Ulna (anterior surface) | 22 | Trochlear notch of ulna |
| 6 | Ulnar tuberosity | 23 | Ulnar tuberosity |
| 7 | Coronoid process | 24 | Neck of radius |
| 8 | Medial epicondyle of humerus | 25 | Ulna (anterior border) |
| 9 | Medial supracondylar crest | 26 | Oblique cord |
| 10 | Humerus (anteromedial surface) | 27 | Ulna (medial surface) |
| 11 | Ulnar collateral ligament (anterior band) | 28 | Ulna (anterior surface) |
| 12 | Ulnar collateral ligament (posterior band) | 29 | Interosseous membrane |
| 13 | Oblique ligament of COOPER | 30 | Shaft of radius |
| 14 | Olecranon | 31 | Ulna (medial surface) |
| 15 | Trochlea of humerus with joint capsule | 32 | Interosseous membrane |
| 16 | Medial epicondyle of humerus | 33 | Radius (interosseous border) |
| 17 | Ulnar collateral ligament (posterior band) | | |



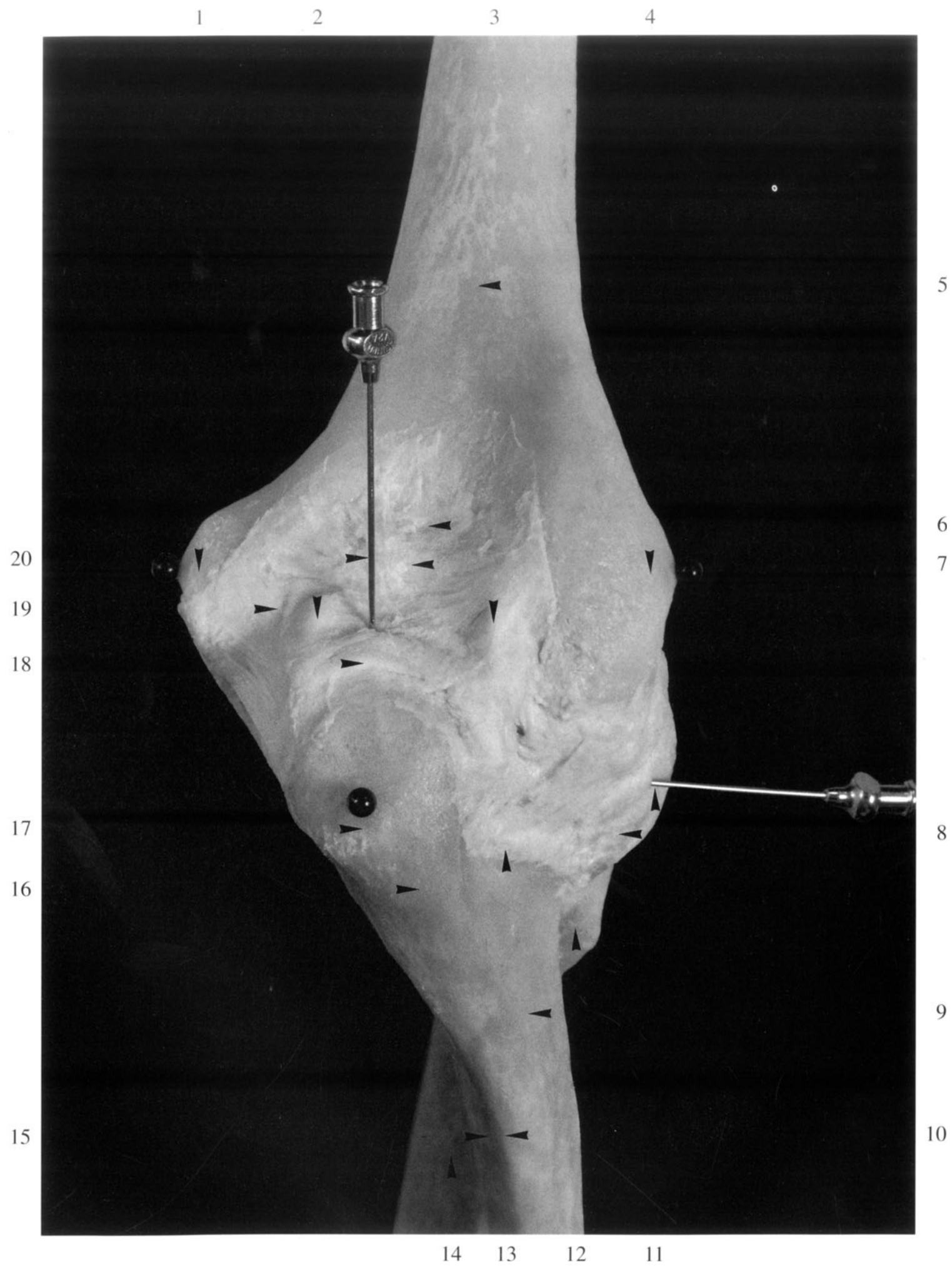
Figure 193

**Elbow Joint 5
Articular Cavity**

- | | | | |
|----|---|----|---|
| 1 | Medial epicondyle | 11 | Ulna (posterior surface) |
| 2 | Ulnar groove of humerus | 12 | Ulna (posterior border) |
| 3 | Joint capsule (fibrous membrane) | 13 | Annular ligament |
| 4 | Proximal radioulnar joint | 14 | Radial tuberosity |
| 5 | Capitulum of humerus | 15 | Ulna (medial surface) |
| 6 | Lateral epicondyle | 16 | Trochlear notch of ulna |
| 7 | Humerus (posterior surface) | 17 | Shaft of radius |
| 8 | Trochlea of humerus | 18 | Subcutaneous area of ulna |
| 9 | Head of radius (articular fovea) | 19 | Olecranon |
| 10 | Attachment of annular ligament
to posterior margin of radial notch of ulna | 20 | Olecranon (cartilage-bearing tip or beak) |
| | | 21 | Olecranon fossa with synovial membrane |



- | | | | |
|----|--|----|--|
| 1 | Medial epicondyle of humerus | 11 | Lateral puncture of elbow joint |
| 2 | Trochlea of humerus | 12 | Radial tuberosity |
| 3 | Trochlea of humerus | 13 | Trochlear notch of ulna (lateral margin) |
| 4 | Lateral epicondyle of humerus | 14 | Shaft of radius |
| 5 | Humerus (posterior surface) | 15 | Ulna (medial surface) |
| 6 | Olecranon fossa (superior border) | 16 | Subcutaneous area of ulna |
| 7 | Joint capsule
(fibrous membrane over olecranon fossa) | 17 | Olecranon |
| 8 | Annular ligament | 18 | Olecranon (tip or beak) |
| 9 | Ulna (posterior surface) | 19 | Ulnar groove |
| 10 | Ulna (posterior border) | 20 | Posterior puncture of elbow joint |



- 1 Posterior puncture of elbow joint
- 2 Olecranon
- 3 Radial collateral ligament
- 4 Lateral puncture of elbow joint
- 5 Annular ligament
- 6 Sacciform recess
- 7 Radial tuberosity
- 8 Ulna (posterior border)
- 9 Radius (posterior border)
- 10 Ulna (interosseous border)
- 11 Ulna (posterior surface)
- 12 Sacciform recess (opened)
- 13 Head of radius
- 14 Radial tuberosity
- 15 Ulna (posterior surface)
- 16 Ulna (posterior border)
- 17 Shaft of radius
- 18 Ulna (interosseous border)
- 19 Supinator crest
- 20 Annular ligament
- 21 Trochlear notch of ulna
(distal cartilaginous surface)
- 22 Trochlea of humerus
- 23 Subcutaneous area of ulna
- 24 Ulna (posterior surface)
- 25 Trochlear notch of ulna (cartilage-free area)
- 26 Trochlear notch of ulna
(proximal cartilaginous surface)
- 27 Capitulum of humerus
- 28 Radial collateral ligament (posterior part)
- 29 Radial collateral ligament (anterior part)
- 30 Lateral epicondyle of humerus
- 31 Humerus (anterolateral surface)
- 32 Lateral supracondylar crest
- 33 Supinator crest (proximal end)
- 34 Lateral epicondyle of humerus
- 35 Lateral supracondylar crest
- 36 Humerus (anterolateral surface)

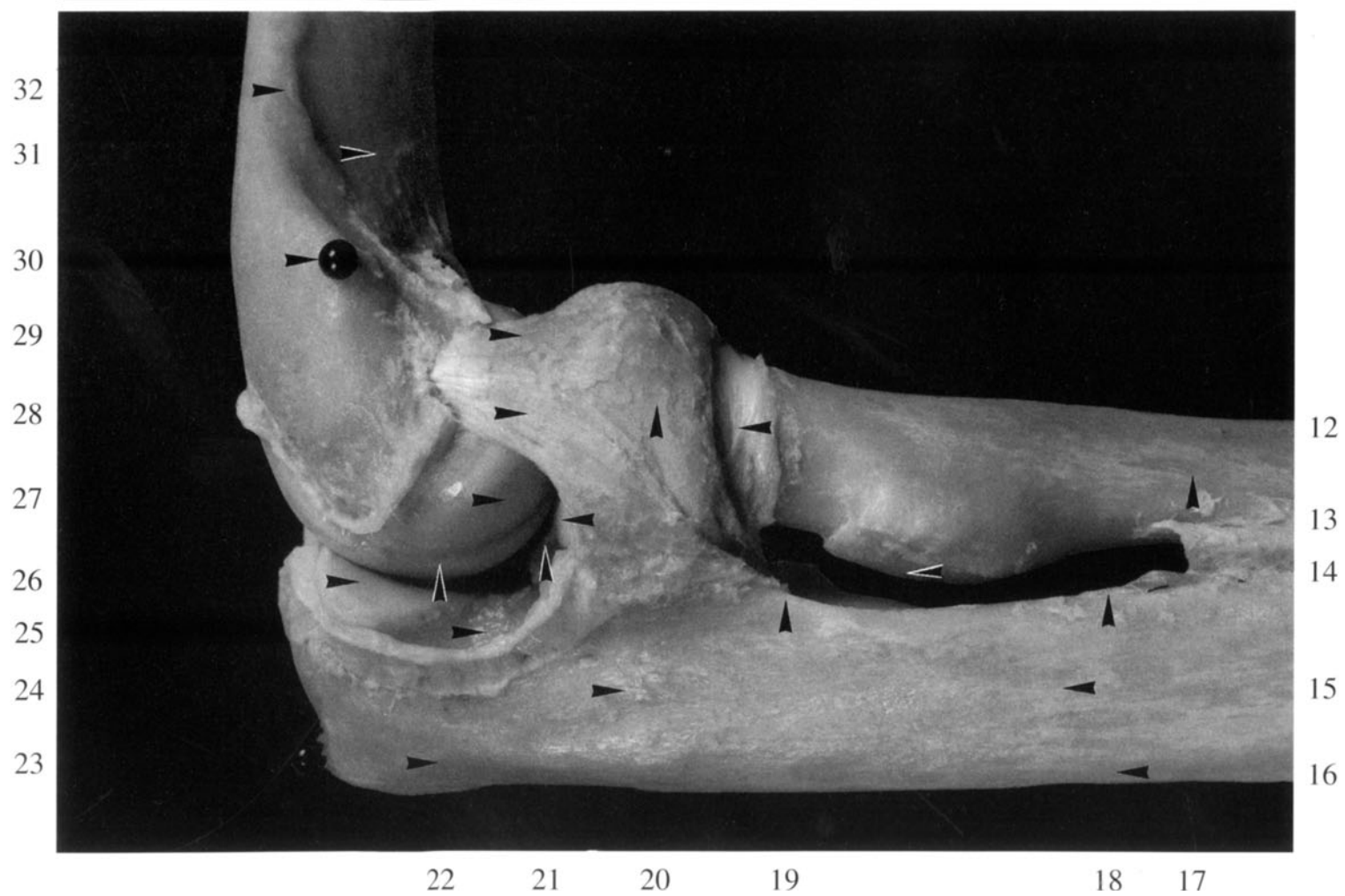
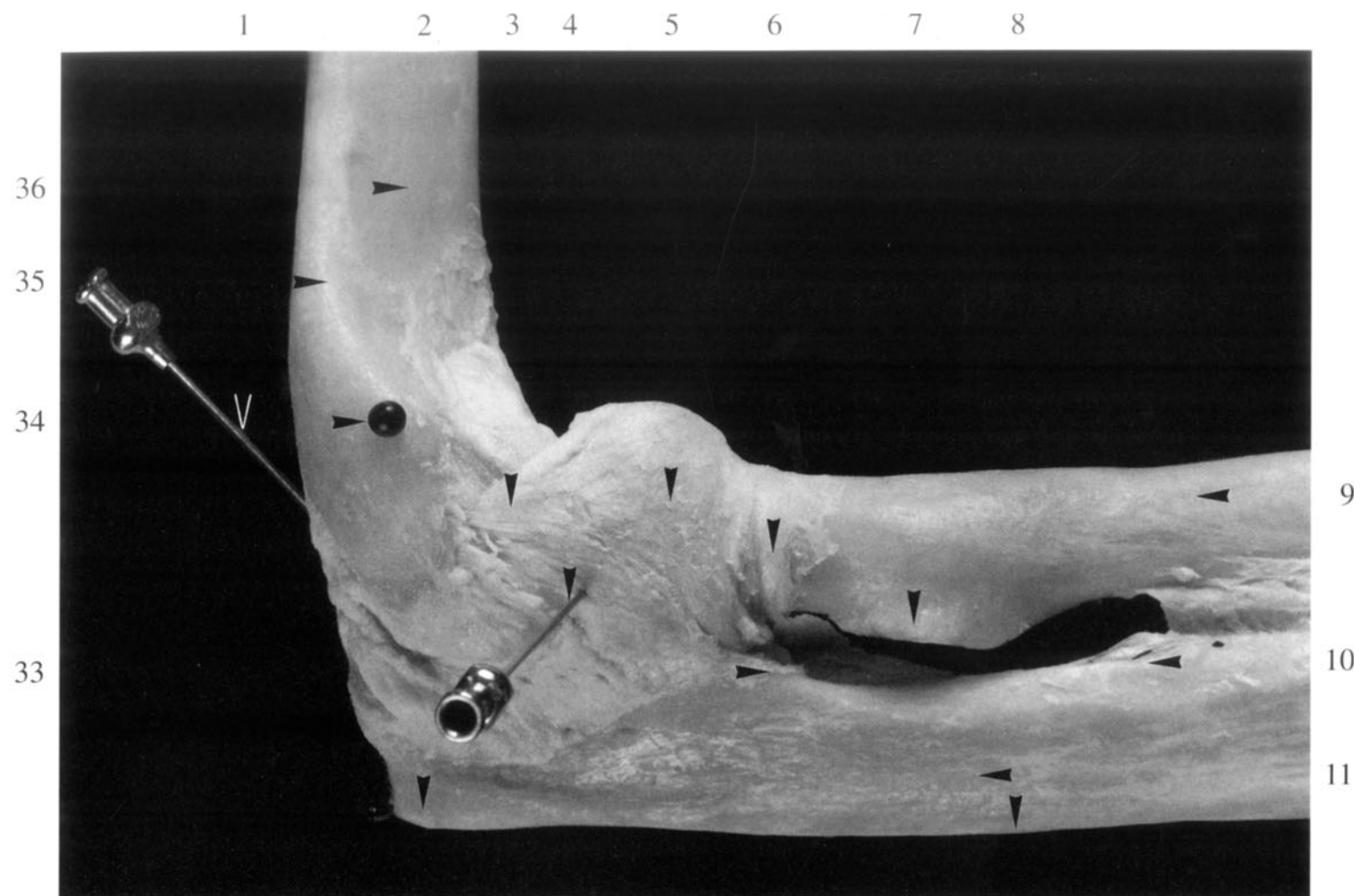


Figure 196**Joints of the Hand 1
Dorsal Aspect**

- | | | | |
|----|---|----|--|
| 1 | Tuberosity of distal phalanx | 18 | Scaphoid bone [navicular bone]
(dorsal cartilage-free diagonal) |
| 2 | Base of middle phalanx | 19 | Carpometacarpal joint of thumb |
| 3 | Base of distal phalanx | 20 | Radius (dorsal tubercle) |
| 4 | Trochlea (head) of middle phalanx | 21 | Radius (styloid process) |
| 5 | Distal interphalangeal joint | 22 | Radial carpal collateral ligament |
| 6 | Trochlea of proximal phalanx | 23 | Radial carpal collateral ligament |
| 7 | Proximal interphalangeal joint | 24 | Carpometacarpal joint
with dorsal carpometacarpal ligament |
| 8 | Metacarpophalangeal joint | 25 | Shaft of third metacarpal bone |
| 9 | Base of third metacarpal bone | 26 | Ulnar sesamoid bone
of metacarpophalangeal joint of thumb |
| 10 | Carpometacarpal joint
with dorsal carpometacarpal ligaments | 27 | Metacarpophalangeal joint of thumb |
| 11 | Dorsal intercarpal ligaments
(dorsal arcuate carpal ligament) | 28 | Head of third metacarpal bone |
| 12 | Triquetral bone | 29 | Capsule of metacarpophalangeal joint |
| 13 | Ulna (styloid process) | 30 | Proximal phalanx |
| 14 | Head of ulna with joint capsule
and groove for extensor carpi ulnaris muscle | 31 | Collateral ligament
of proximal interphalangeal joint |
| 15 | Ulnar carpal collateral ligament | 32 | Middle phalanx |
| 16 | Dorsal radiocarpal ligament | 33 | Collateral ligament of distal interphalangeal joint |
| 17 | Styloid process of metacarpal bone
and capsule of midcarpal joint | 34 | Distal phalanx |



Figure 197

**Joints of the Hand 2
Palmar Aspect**

- | | | | |
|----|--|----|--|
| 1 | Fifth metacarpophalangeal joint | 19 | Hook of hamate bone with pisohamate ligament |
| 2 | Base of distal phalanx | 20 | Pisometacarpal ligament |
| 3 | Base of middle phalanx | 21 | Ulna (styloid process) |
| 4 | Tuberosity of distal phalanx | 22 | Distal radioulnar joint |
| 5 | Deep transverse metacarpal ligament | 23 | Palmar ulnocarpal ligament |
| 6 | Interphalangeal joint of thumb | 24 | Pisiform bone |
| 7 | Distal interphalangeal joint | 25 | Capitate bone with radiate carpal ligament |
| 8 | Proximal interphalangeal joint | 26 | Palmar carpometacarpal ligaments |
| 9 | Collateral ligament
of interphalangeal joint of thumb | 27 | Shaft of third metacarpal bone |
| 10 | Palmar ligament | 28 | Deep transverse metacarpal ligament |
| 11 | Sesamoid bones
of metacarpophalangeal joint of thumb | 29 | Digital tendon sheath of hand
(attachment to palmar ligament, cut edge) |
| 12 | Shaft of first metacarpal bone | 30 | Base of proximal phalanx |
| 13 | Carpometacarpal joint of thumb | 31 | Proximal phalanx |
| 14 | Tubercle of trapezium | 32 | Collateral ligament
of proximal interphalangeal joint |
| 15 | [Palmar arcuate carpal ligament] | 33 | Trochlea of proximal phalanx |
| 16 | Palmar radiocarpal ligament | 34 | Middle phalanx |
| 17 | Canal for flexor carpi radialis tendon | 35 | Trochlea of middle phalanx |
| 18 | Lunate bone | | |



Figure 198

**Joints of the Hand 3
Carpal Joints**

- | | | | |
|----|-------------------------------|----|------------------------------------|
| 1 | First metacarpal bone | 15 | Ulna |
| 2 | Trapezium bone | 16 | Fissure in articular disc |
| 3 | Trapezoid bone | 17 | Articular disc [triangular disc] |
| 4 | Capitate bone | 18 | Interosseous membrane |
| 5 | Hamate bone | 19 | Lunate bone |
| 6 | Fifth metacarpal bone | 20 | Carpal articular surface of radius |
| 7 | Third metacarpal bone | 21 | Radius |
| 8 | Carpometacarpal joint | 22 | Radial carpal collateral ligament |
| 9 | Carpometacarpal joint | 23 | Radius (styloid process) |
| 10 | Triquetral bone | 24 | Scaphoid bone |
| 11 | Triquetral bone | 25 | Scaphoid bone |
| 12 | Ulna (styloid process) | 26 | Carpometacarpal joint of thumb |
| 13 | Distal radioulnar joint | 27 | Carpometacarpal joint |
| 14 | Ulnar head with joint capsule | 28 | Base of second metacarpal bone |

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

28

27

26

25

24

23

22

21

20

19

18

17

16



Figure 199

**Joints of the Hand 4
Carpal Joint Mechanics 1**

- | | | | |
|----|---|----|--------------------------------|
| 1 | Radius (styloid process) | 21 | Trapezoid bone |
| 2 | Capitate bone | 22 | Trapezoid bone |
| 3 | Lunate bone | 23 | Capitate bone |
| 4 | Triquetral bone | 24 | Radius (styloid process) |
| 5 | Ulna (styloid process) | 25 | Radius (dorsal tubercle) |
| 6 | Radius (styloid process) | 26 | Hamate bone |
| 7 | Trapezium bone | 27 | Scaphoid bone |
| 8 | Trapezoid bone | 28 | Trapezium bone |
| 9 | Capitate bone | 29 | Tubercle of scaphoid bone |
| 10 | Hamate bone | 30 | Scaphoid bone |
| 11 | Triquetral bone | 31 | Carpometacarpal joint of thumb |
| 12 | Third metacarpal bone | 32 | Tubercle of scaphoid bone |
| 13 | Third metacarpal bone (styloid process) | 33 | Radius (styloid process) |
| 14 | Scaphoid bone | 34 | Scaphoid bone |
| 15 | Scaphoid bone | 35 | Trapezium bone |
| 16 | Lunate bone | 36 | Trapezoid bone |
| 17 | Distal radioulnar joint | 37 | Radius (dorsal tubercle) |
| 18 | Radius | 38 | Scaphoid bone |
| 19 | Ulna | 39 | Scaphoid bone |
| 20 | Carpometacarpal joint of thumb | 40 | Trapezoid bone |

1 2 3 4 5

6 7 8 9 10 11

40

39

38

37

12

13

14

15

16

17

18

19

36

35

34

33

20

21

22

23

24

25

32 31 30

29 28 27 26

Figure 200

**Joints of the Hand 5
Carpal Joint Mechanics 2**

- | | | | |
|----|---|----|--|
| 1 | Radius | 15 | Middle phalanx
(of middle finger, in dorsiflexed hand) |
| 2 | Radius (dorsal tubercle) | 16 | Middle phalanx
(of index finger, in palmar-flexed hand) |
| 3 | Capitate bone | 17 | Proximal phalanx
(of index finger, in palmar-flexed hand) |
| 4 | Radius (styloid process) | 18 | Head of second metacarpal bone
(in palmar-flexed hand) |
| 5 | Carpometacarpal joint of thumb
(in dorsiflexed hand) | 19 | Head of third metacarpal bone
(in palmar-flexed hand) |
| 6 | Radius (styloid process) | 20 | Shaft of second metacarpal bone
(in palmar-flexed hand) |
| 7 | Radius | 21 | Shaft of third metacarpal bone
(in dorsiflexed hand) |
| 8 | Radius (dorsal tubercle) | 22 | Base of second metacarpal bone
(in dorsiflexed hand) |
| 9 | Proximal row of carpal bones (lunate bone) | 23 | Trapezoid bone (in dorsiflexed hand) |
| 10 | Carpometacarpal joint of thumb
(in palmar-flexed hand) | 24 | Proximal row of carpal bones (lunate bone) |
| 11 | First metacarpal bone (in dorsiflexed hand) | | |
| 12 | First metacarpal bone (in palmar-flexed hand) | | |
| 13 | Proximal phalanx of thumb (in dorsiflexed hand) | | |
| 14 | Proximal phalanx of thumb
(in palmar-flexed hand) | | |



- | | |
|--|--|
| 1 Radius (styloid process) | 14 Head of fourth metacarpal bone |
| 2 Radius (anterior surface) | 15 Pisometacarpal ligament |
| 3 Interosseous membrane | 16 Pisiform bone |
| 4 Ulna (styloid process) | 17 Pisohamate ligament |
| 5 Ulna (anterior surface) | 18 Radiate carpal ligament |
| 6 Distal radioulnar joint | 19 Deep transverse metacarpal ligament |
| 7 Connection
between distal radioulnar joint capsule
and radiocarpal joint capsule at articular disc | 20 Palmar ligament |
| 8 Lunate bone
(covered by palmar radiocarpal ligament) | 21 Radiate carpal ligament |
| 9 Palmar ulnocarpal ligament | 22 Canal for flexor carpi radialis tendon |
| 10 Flexor retinaculum [transverse carpal ligament]
(cut edge) | 23 Tubercle of trapezium |
| 11 Capitate bone | 24 Carpometacarpal joint of thumb |
| 12 Flexor retinaculum [transverse carpal ligament]
(cut edge) | 25 Deep transverse metacarpal ligament |
| 13 Hook of hamate bone | 26 Head of second metacarpal bone |
| | 27 Flexor retinaculum [transverse carpal ligament]
(cut edge) |
| | 28 Tubercle of scaphoid |
| | 29 Palmar radiocarpal ligament (capitate portion) |
| | 30 Palmar radiocarpal ligament (lunate portion) |

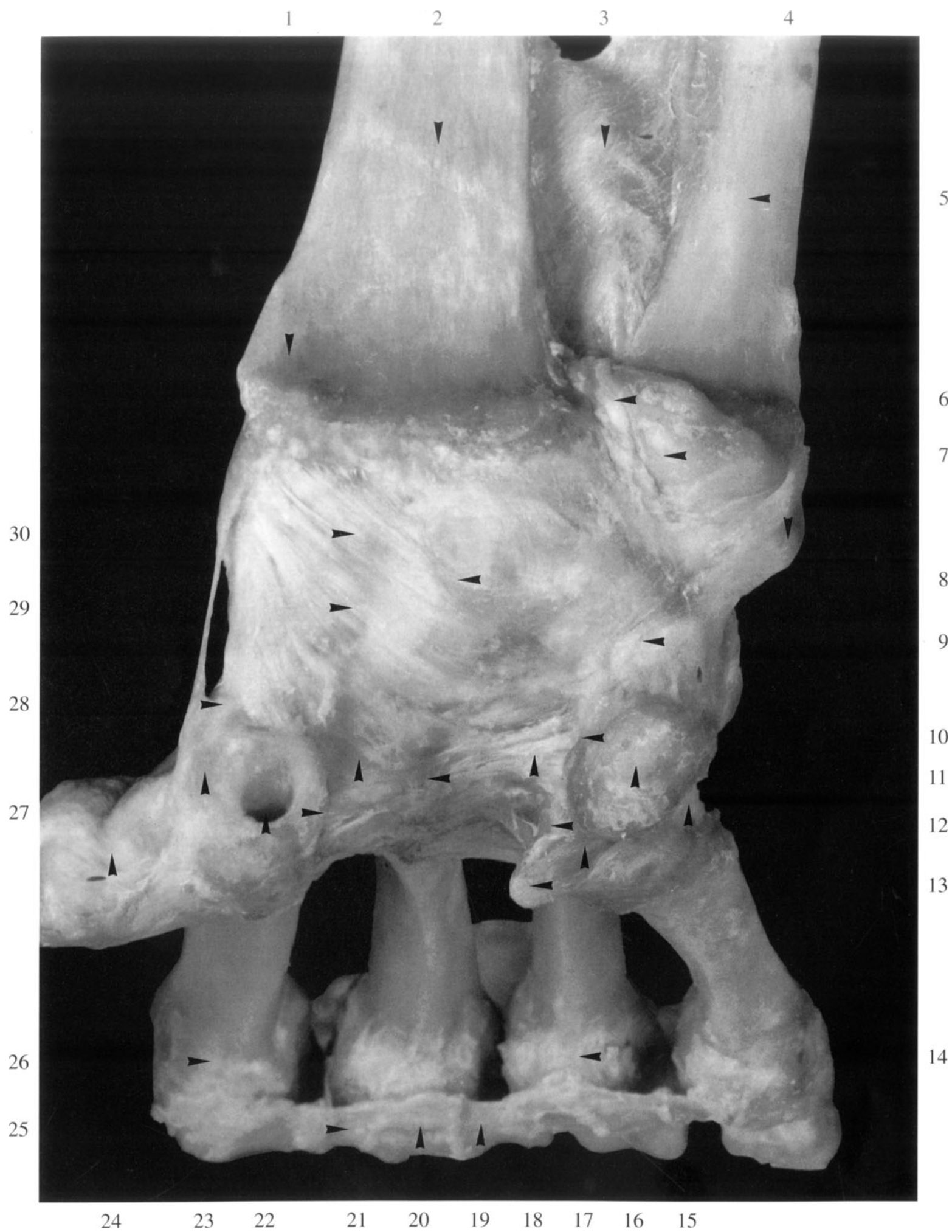


Figure 202

Joints of the Hand 7
Puncture of the Radiocarpal Joint 1

- | | | | |
|----|--|----|--|
| 1 | Carpometacarpal joint of thumb | 19 | Ulnar head with joint capsule |
| 2 | Sesamoid bone | 20 | Distal radioulnar joint |
| 3 | Third metacarpal bone (styloid process) | 21 | Dorsal radiocarpal ligament |
| 4 | Head of second metacarpal bone
with joint capsule | 22 | Groove for extensor pollicis longus tendon |
| 5 | Deep transverse metacarpal ligament | 23 | Radius |
| 6 | Metacarpophalangeal joint of middle finger | 24 | Radius (styloid process) |
| 7 | Head of fourth metacarpal bone
with joint capsule | 25 | Radial puncture of radiocarpal joint |
| 8 | Shaft of third metacarpal bone | 26 | Groove for tendons of abductor pollicis longus
and extensor pollicis brevis muscles |
| 9 | Shaft of fifth metacarpal bone | 27 | Radius (dorsal tubercle) |
| 10 | Base of third metacarpal bone | 28 | Scaphoid bone
(covered by radiocarpal joint capsule) |
| 11 | Dorsal carpometacarpal ligaments | 29 | Dorsal intercarpal ligaments
(dorsal arcuate carpal ligament) |
| 12 | Hamate bone | 30 | Dorsal intercarpal ligament
(between scaphoid and trapezoid) |
| 13 | Triquetral bone | 31 | Trapezoid bone |
| 14 | Ulna (styloid process) | 32 | Dorsal carpometacarpal ligaments |
| 15 | Groove for extensor carpi ulnaris tendon | 33 | Base of second metacarpal bone |
| 16 | Interosseous membrane | 34 | Metacarpophalangeal joint of the thumb |
| 17 | Base of fifth metacarpal bone | | |
| 18 | Ulna | | |

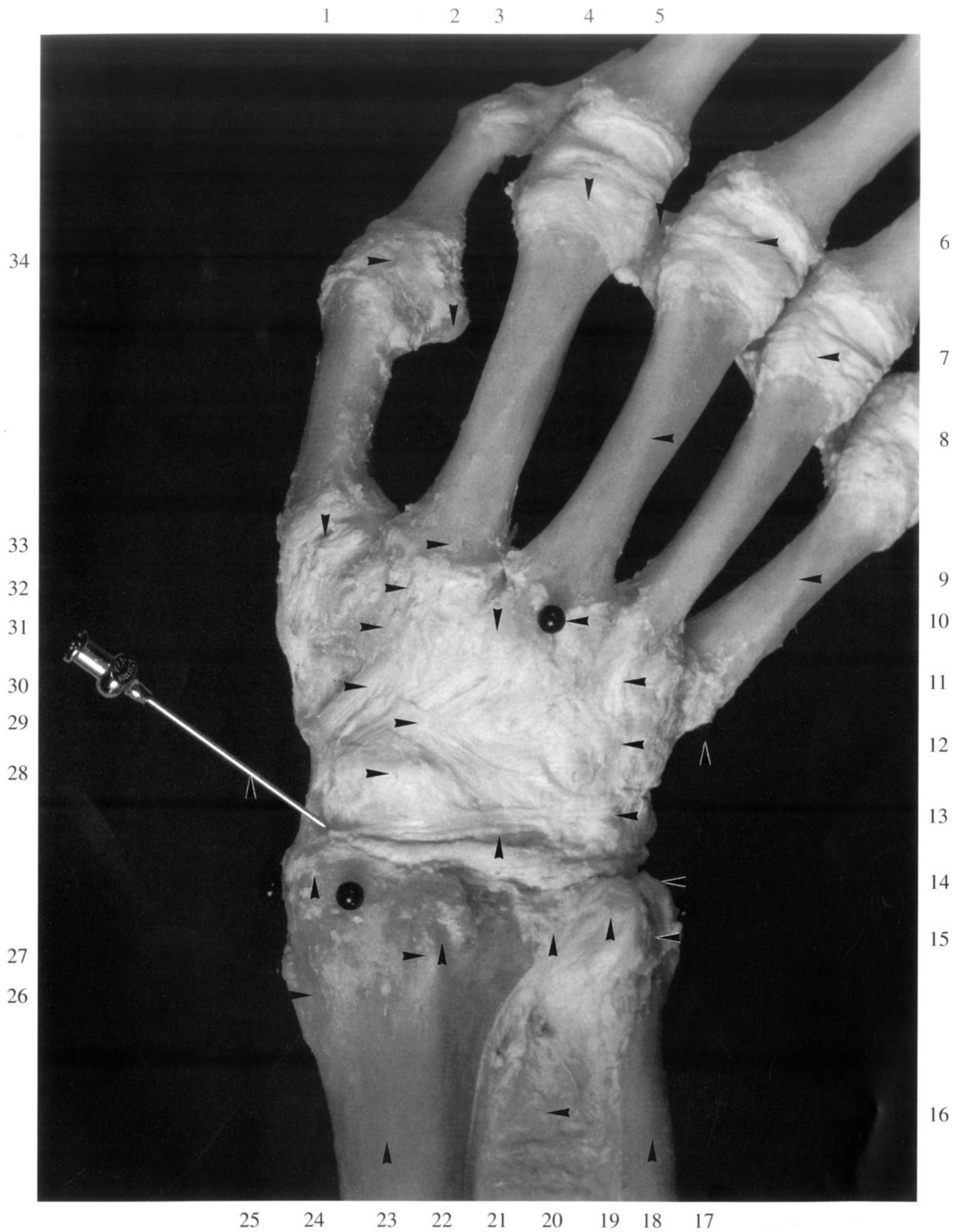


Figure 203

Joints of the Hand 8
Puncture of the Radiocarpal Joint 2

- | | | | |
|----|--|----|--|
| 1 | Metacarpophalangeal joint of thumb | 17 | Extensor digiti minimi muscle |
| 2 | Adductor pollicis muscle | 18 | Tendon sheath of extensor carpi ulnaris muscle |
| 3 | Second metacarpal bone | 19 | Extensor digitorum muscle |
| 4 | Extensor digitorum muscle
(tendon for index finger) | 20 | Site for radiodorsal puncture of radiocarpal joint |
| 5 | Second dorsal interosseous muscle | 21 | Base of second metacarpal bone |
| 6 | Extensor digiti minimi muscle
(tendon of insertion) | 22 | Tendon sheath
of extensores carpi radiales muscles |
| 7 | Extensor indicis muscle (tendon of insertion) | 23 | Radial puncture of radiocarpal joint |
| 8 | Intertendinous connection | 24 | Tendon sheath of abductor longus
and extensor brevis pollicis muscles |
| 9 | Extensor digitorum tendon for middle finger | 25 | Tendon sheath of extensor pollicis longus muscle |
| 10 | Extensor digitorum tendon for ring finger | 26 | Tendon sheath of extensor pollicis longus muscle |
| 11 | Second dorsal interosseous muscle | 27 | Tendon sheath of extensor pollicis longus muscle |
| 12 | Extensor carpi radialis brevis muscle
(tendon of insertion) | 28 | Extensor carpi radialis longus muscle
(tendon of insertion) |
| 13 | Tendon sheath
of extensor digitorum
and extensor indicis muscles | 29 | Extensor pollicis longus muscle
(tendon of insertion) |
| 14 | Tendon sheath
of extensores carpi radiales muscles | 30 | First metacarpal bone |
| 15 | Tendon sheath of extensor digiti minimi muscle | 31 | Extensor pollicis brevis muscle
(tendon of insertion) |
| 16 | Extensor retinaculum [dorsal carpal ligament] | 32 | First dorsal interosseous muscle |



Figure 204 **Joints of the Hand 9**
Puncture of the Radiocarpal
and Midcarpal Joints 1

- | | | | |
|----|--|----|--|
| 1 | Carpometacarpal joint of thumb | 16 | Groove for extensor carpi ulnaris tendon |
| 2 | Trapezoid bone | 17 | Ulnar head with joint capsule |
| 3 | Third metacarpal bone (styloid process) | 18 | Distal radioulnar joint |
| 4 | Base of third metacarpal bone | 19 | Groove for tendon of extensor pollicis longus |
| 5 | Dorsal intercarpal ligaments
(dorsal arcuate carpal ligament) | 20 | Groove for tendons of abductor pollicis longus
and extensor pollicis brevis muscles |
| 6 | Hamate bone | 21 | Radius |
| 7 | Base of fifth metacarpal bone | 22 | Radius (dorsal tubercle) |
| 8 | Ulnar puncture of midcarpal joint | 23 | Radius (styloid process) |
| 9 | Deep transverse metacarpal ligament | 24 | Dorsal radiocarpal ligament |
| 10 | Dorsal carpometacarpal ligaments | 25 | Tubercle of scaphoid bone |
| 11 | Triquetral bone | 26 | Scaphoid bone |
| 12 | Ulna (styloid process) | 27 | Dorsal puncture of midcarpal joint |
| 13 | Interosseous membrane | 28 | Carpometacarpal joint of index finger |
| 14 | Ulna | 29 | Deep transverse metacarpal ligament |
| 15 | Ulnar puncture of radiocarpal joint | 30 | Metacarpophalangeal joint of middle finger |

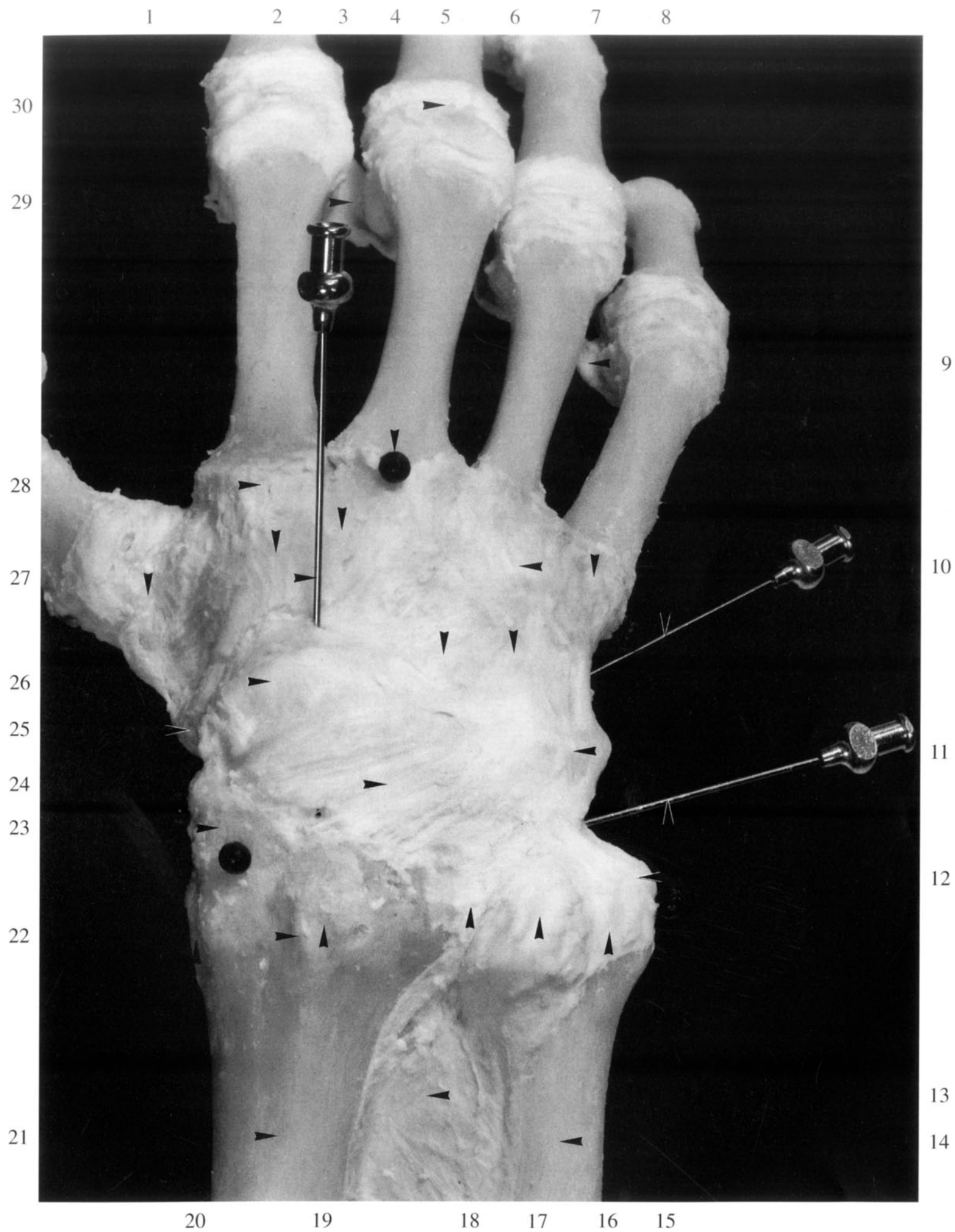
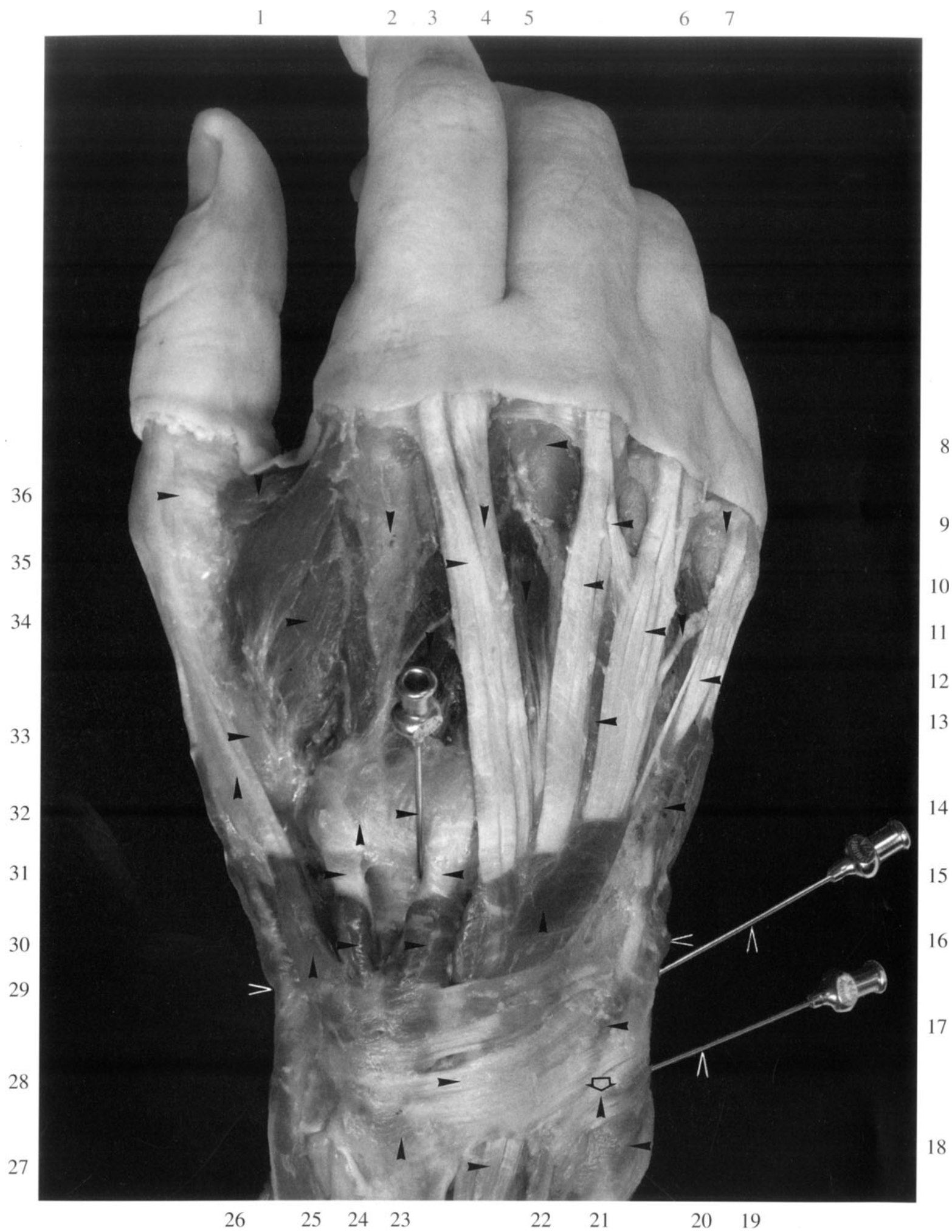


Figure 205

**Joints of the Hand 10
Puncture of the Radiocarpal
and Midcarpal Joints 2**

- | | |
|--|---|
| 1 Adductor pollicis muscle | 20 Ulnar puncture of radiocarpal joint |
| 2 Second metacarpal bone | 21 Site for ulnodorsal puncture of radiocarpal joint |
| 3 Second dorsal interosseous muscle | 22 Tendon sheath of extensor digitorum
and extensor indicis muscles |
| 4 Extensor indicis muscle (tendon of insertion) | 23 Tendon sheath of extensor pollicis longus muscle |
| 5 Second dorsal interosseous muscle | 24 Base of second metacarpal bone |
| 6 Extensor digitorum tendon for little finger
and fourth dorsal interosseous muscle | 25 Tendon sheath of extensor pollicis longus muscle |
| 7 Metacarpophalangeal joint of little finger | 26 Extensor pollicis longus muscle
(tendon of insertion) |
| 8 Metacarpophalangeal joint of middle finger | 27 Extensor digitorum muscle (tendon of insertion) |
| 9 Intertendinous connection | 28 Extensor retinaculum [dorsal carpal ligament] |
| 10 Extensor digitorum tendon for middle finger | 29 Tendon sheath of abductor longus
and extensor brevis pollicis muscles |
| 11 Extensor digitorum tendon for ring finger | 30 Tendon sheath
of extensores carpi radiales muscles |
| 12 Extensor digiti minimi muscle
(tendon of insertion) | 31 Extensor carpi radialis longus muscle
(tendon of insertion) |
| 13 Third dorsal interosseous muscle | 32 Dorsal puncture of midcarpal joint |
| 14 Tendon sheath of extensor digiti minimi muscle | 33 First metacarpal bone |
| 15 Extensor carpi radialis brevis muscle
(tendon of insertion) | 34 First dorsal interosseous muscle |
| 16 Tendon sheath of extensor carpi ulnaris muscle | 35 Extensor digitorum tendon for index finger |
| 17 Tendon sheath of extensor digiti minimi muscle | 36 Metacarpophalangeal joint of thumb |
| 18 Tendon sheath of extensor carpi ulnaris muscle | |
| 19 Ulnar puncture of midcarpal joint | |



Index

- Abdomen, linea alba Fig. 79
Acinus, middle lobe, Fig. 97
Acoustic meatus, cartilaginous Figs. 39, 40
Acromial angle, gonion Figs. 186, 188
Acromion Figs. 62, 64–66, 123, 184–188
 acromial rete Fig. 62
Angular incisure Fig. 111
Angular spine Fig. 45
Ansa cervicalis Figs. 8, 9, 11–14, 16–18, 25, 26, 28, 29, 31, 60
 anterior root Figs. 9, 11–14, 17, 18, 25, 26, 28, 29
 posterior root Figs. 16, 18, 25, 26, 31, 60
 superficial Figs. 33, 34
Ansa subclavia Fig. 28
Antebrachial region Figs. 158–164, 179–181
 anterior Fig. 158
 posterior Figs. 178–181
Anterior carpal region Fig. 165
Anterior cubital region Figs. 150–157
Anterior right ventricular branch Figs. 112, 114, 115
Anterior semilunar valve, nodule Fig. 122
Antitragus Fig. 2
Aorta
 arch Figs. 96, 102, 103, 105, 106, 110, 113 I, 114, 118
 ascending Figs. 96, 104, 112–122
 recess Fig. 117
 sinus Figs. 116, 120
 valve, posterior cusp Fig. 122
 valve, right cusp Fig. 122
Arachnoid, spinal Fig. 76
Areola, mamillary branch Fig. 86
Arm
 medial intermuscular septum Figs. 144, 150, 153–157
 lateral intermuscular septum Figs. 145–148, 155
 posterior compartment Figs. 141, 146
Artery
 anterior auricular Figs. 40, 46
 anterior ciliary Fig. 51
 anterior circumflex humeral Figs. 133, 140, 141
 anterior interosseous Figs. 163, 164, 179–181
 anterior interventricular, diagonal branch Fig. 117
 anterior interventricular, lateral branch Fig. 117
 anterior intraventricular, collateral branch Figs. 112, 114, 115, 117
 anterior tympanic Fig. 45
 ascending cervical Figs. 9, 27–32
 ascending palatine Fig. 40
 axillary Figs. 126, 127, 133, 134, 138, 139–141
 brachial Figs. 140, 141, 143, 144, 154–164
 brachial, cutaneous branches Figs. 128, 130–132, 135, 137, 138, 142, 143
 brachial, muscular branch Figs. 134, 140, 144
 brachial, musculocutaneous branch Fig. 144
 brachial, venae comitantes Figs. 155, 156, 158, 160
 bronchial Figs. 105, 106
 buccal Figs. 34, 42, 43, 45
 buccal, anastomotic branch Fig. 34
 circumflex scapular Figs. 66, 133, 134, 138, 139
 common carotid Figs. 8, 10–17, 21–27, 109
 common carotid, left Figs. 110, 118, 119
 common carotid, right Fig. 108
 common interosseous Fig. 164
 common palmar digital Figs. 167–171, 174, 175
 conjunctival Figs. 50, 51
 conjunctival, posterior Figs. 50, 51
 coronary, cutaneous branches, anterior Figs. 83–85
 coronary, cutaneous branches, brachial Fig. 144
 coronary, cutaneous branches, posterior Figs. 64, 67–73, 77
 coronary, posterior interventricular branch Fig. 113 I
 deep anterior temporal Figs. 43, 45, 48
 deep auricular Fig. 45
 deep brachial Figs. 131, 132, 141, 144
 deep brachial, cutaneous branch Figs. 131, 132
 deep brachial, deltoid branch/ascending branch Fig. 141
 deep cervical Figs. 28, 52, 58–60
 descending palatine Fig. 45
 dorsal nasal Fig. 50
 dorsal scapular Figs. 54, 62, 63
 external carotid Figs. 8, 13–18, 25–29, 30, 40, 43–45
 facial Figs. 13, 15, 17, 18, 34–42
 facial, inferior labial branch Figs. 39, 42
 facial, lateral nasal branch Fig. 42
 facial, masseteric and glandular branch Fig. 39
 facial, masseteric branches Fig. 40
 facial, superior labial branch Fig. 42
 index finger, radial Figs. 167–170
 inferior alveolar Figs. 43, 45
 inferior alveolar, mylohyoid branch Figs. 43, 45
 inferior diaphragmatic Fig. 108

Artery

inferior labial Figs. 41, 43
inferior laryngeal Fig. 24
inferior thyroid Figs. 23–29, 31, 32
inferior thyroid, esophageal branch Fig. 24
inferior thyroid, pharyngeal branch Fig. 24
infraorbital Fig. 45
infraorbital, lacrimal branch (variant) Fig. 49
intercostal, fourth, lateral mammary branch Fig. 89
internal carotid Figs. 14, 16–18, 25–27
internal thoracic Figs. 79, 82–87, 95, 96, 98–100, 102–106, 108–110, 113, 116, 117, 135, 137–139
internal thoracic, anterior intercostal branches Fig. 85
internal thoracic, medial mammary branches Figs. 82–84, 86–90, 92, 94, 95, 137
internal thoracic, perforating branches Figs. 79, 82–88, 90, 91, 94, 95, 135, 137–139
internal thoracic, sternal branches Fig. 79
lacrimal Figs. 49–51
lacrimal, posterior conjunctival branch Fig. 51
lateral inferior palpebral Fig. 50
lateral posterior cutaneous Fig. 74
lateral thoracic Figs. 130–132, 134, 136–141
lateral thoracic, mammary branches Figs. 90, 95
left coronary Figs. 112–117, 119, 121
left coronary, circumflex branch Fig. 117
left coronary, left marginal branch Fig. 113 I
left coronary, posterior left ventricular branch Figs. 113 I, 117, 121
left coronary, right ventricular branch Figs. 114–116
left pulmonary Figs. 103–107, 110, 119
left pulmonary, anterior basal branch Fig. 107
left pulmonary, inferior lingular branch Fig. 107
left pulmonary, medial basal branch Fig. 107
left pulmonary, superior lingular branch Fig. 107
left pulmonary, superior lobar branches Fig. 107
left pulmonary, superior trunk Fig. 107
lingual Figs. 13, 14, 18, 25, 26, 34
lumbar, first Figs. 72, 75
lumbar, first, dorsal ramus Fig. 72
lumbar, second, posterior branch Fig. 75
lumbar, third, posterior branch Fig. 75
masseteric Fig. 40
maxillary Figs. 43–45
maxillary, pterygoid branch Fig. 45
medial inferior palpebral Fig. 50
median Figs. 161–164
meningo-orbital Fig. 48
middle collateral, anterior branch Figs. 145, 148
middle collateral, deep brachial Figs. 141, 147, 148
middle collateral, posterior branch Figs. 145, 148
middle meningeal Figs. 45–49
middle meningeal, frontal branch Figs. 48, 49
middle meningeal, orbital branch Figs. 48, 49
middle meningeal, parietal branch Figs. 48, 49

Artery

middle temporal Fig. 41
middle temporal, accessory (variant) Figs. 39, 40
musculophrenic Figs. 96, 103, 105
nasofrontal Fig. 49
neck, transverse cervical Figs. 1, 29–32, 35, 54, 55, 62
neck, transverse cervical, deep branch Figs. 31, 32, 61–63, 65, 67, 68, 70, 71
neck, transverse cervical, superficial branch Figs. 30–32, 61, 63, 65, 68
occipital Figs. 13, 17, 26, 39, 40, 52–59, 61–63
occipital, descending branch Fig. 59
occipital, occipital branch Figs. 54, 55
ophthalmic Fig. 49
oral coronary, superior Fig. 42
palmar metacarpal Fig. 171
palpebral, superior Fig. 50
pericardiophrenic Figs. 98–106, 108–110, 112, 115
pericardiophrenic, pericardial branch Fig. 104
posterior auricular Figs. 18, 35, 39–41, 45, 52, 59, 61, 62
posterior auricular, auricular branch Fig. 40
posterior auricular, occipital branch Fig. 40
posterior auricular, parotid branch Figs. 40, 41
posterior ciliary Fig. 49
posterior circumflex humeral Figs. 66, 133, 134, 139
posterior intercostal Figs. 68, 73, 74, 84, 89, 108–110, 129, 130, 132, 133, 135, 137, 138
posterior intercostal, anterior cutaneous branch Fig. 83
posterior intercostal, bronchial branch Figs. 108, 109
posterior intercostal, collateral branch (supracostal branch) Fig. 74
posterior intercostal, dorsal branch Figs. 54, 73, 74
posterior intercostal, lateral cutaneous branch Figs. 130–132, 137–139
posterior intercostal, lateral mammary branch Figs. 83, 84, 87, 89, 94
posterior intercostal, muscular branch Fig. 74
posterior interosseous Figs. 180, 181
posterior lateral cutaneous Figs. 73, 74
posterior superior alveolar Fig. 45
posterior temporal Figs. 43, 45, 48
proper palmar digital Figs. 165, 167–171, 174, 175
proper palmar digital, distal anastomotic branch Fig. 170
radial Figs. 156–165, 169, 171–173
radial recurrent Figs. 156, 157, 160–164
radial recurrent, muscular branch Fig. 157
radial, palmar carpal branch Figs. 158, 161, 165, 169
radial, superficial carpal branch Figs. 165, 167, 169
radial, superficial palmar branch Figs. 165, 167, 169
radial, venae comitantes Figs. 156, 158–160
recurrent interosseous Fig. 181
right coronary Figs. 112–116, 122
right coronary, conal branch Figs. 112, 114, 115, 116
right coronary, conus branch Fig. 116
right coronary, right marginal branch Figs. 115, 122

Artery

right coronary, right posterolateral branch Fig. 113 I
right coronary, sinoatrial nodal branch Figs. 115, 116
right pulmonary Figs. 99, 100, 107, 108
right pulmonary, anterior ascending branch Fig. 107
right pulmonary, anterior basal branch Fig. 107
right pulmonary, anterior trunk Figs. 100, 107
right pulmonary, interlobar part Fig. 107
right pulmonary, medial basal branch Fig. 107
right pulmonary, posterior descending branch Fig. 107
right pulmonary, superior lobar branches Fig. 107
sternocleidomastoid Figs. 8, 9, 13–15, 17, 18, 35
subclavian Figs. 29, 63, 109, 110, 118, 119
subclavian, left Figs. 110, 118, 119
submental Figs. 33, 34, 38, 39
subscapular Figs. 129, 131, 133, 138–141
subscapular, circumflex branch Fig. 141
superficial cervical Fig. 68
superficial temporal Figs. 18, 35–38
superficial temporal, anterior auricular branches
Figs. 38, 39, 41–43, 45
superficial temporal, frontal branch Figs. 42, 46, 48
superficial temporal, parietal branch Figs. 42, 46, 48
superficial temporal, parotid branch Figs. 39, 40
superficial thoracic (Manhot) Figs. 87–91, 133, 135–139
superficial thoracic, superior (Manhot) Fig. 79
superior epigastric Figs. 116, 117
superior epigastric, cutaneous branch Fig. 83
superior labial Fig. 37
superior laryngeal Figs. 12, 14, 15, 17, 18, 26–28
superior radial collateral Fig. 140
superior thoracic Fig. 127
superior thyroid Figs. 5–7, 9, 11–15, 17–23, 23–27, 29, 35,
36
superior thyroid, anterior branch Figs. 21, 22
superior thyroid, cricothyroid branch Figs. 5–7, 21, 22
superior thyroid, cutaneous branch Figs. 19, 20
superior thyroid, sternocleidomastoid branch Figs. 8, 17
superior ulnar collateral Figs. 130, 140, 144
supraorbital Fig. 50
suprascapular Figs. 30, 32, 55, 58
suprascapular, suprasternal branch Fig. 1
suprascapular, thoracic branch Fig. 30
supratrochlear Fig. 50
thoracoacromial Figs. 86–88, 92, 123–127, 129, 134, 135,
139
thoracoacromial, acromial branch Figs. 126, 127
thoracoacromial, anterior interventricular branch
Figs. 112, 114, 115, 117
thoracoacromial, cervical cardiac branch, superior
Figs. 27, 28
thoracoacromial, clavicular branch Figs. 126, 127
thoracoacromial, deltoid branch Figs. 123–127, 139
thoracoacromial, pectoral branch Figs. 125–127, 139
thoracoacromial, thoracic cutaneous branch Figs. 86–88

Artery

thoracodorsal Figs. 129, 133, 134, 138, 140, 141
thumb, principal Figs. 168–170, 174
thymic Figs. 96, 98, 101–103
thyroid ima Figs. 4–7
transverse cervical Figs. 63, 68
transverse cervical, deep branch Fig. 68
transverse facial Figs. 33, 37–41, 45
transverse facial, masseteric branch Fig. 40
transverse facial, parotid branch Fig. 39
ulnar Figs. 158, 159, 161–165, 167–169, 171, 173
ulnar recurrent Figs. 157, 161–164
ulnar recurrent, anterior branch Fig. 164
ulnar recurrent, posterior branch Fig. 164
ulnar, deep palmar branch Figs. 165, 171
ulnar, palmar carpal branch Fig. 165
ulnar, venae comitantes Figs. 158, 159
vertebral Figs. 27, 28, 59, 60
vertebral, muscular branch Fig. 59
zygomatico-orbital Figs. 18, 37, 39–41, 50
Articular disc Figs. 44, 45, 198
Articular tubercle Figs. 42, 43
Atlanto-occipital membrane, posterior Figs. 59, 60
Atlas
arch, posterior Figs. 59, 60
transverse process Figs. 18, 40
Atrial appendage
left Figs. 103, 112–122
right Figs. 112, 113, 115, 116, 118–122
Atrial branches Fig. 121
Atrioventricular orifice
left Fig. 121
right Fig. 121
Atrioventricular septum Fig. 121
Atrioventricular valve
left Fig. 119
right Fig. 119
Atrium
left Figs. 113 I, 113 II, 120, 121
right Figs. 115–118, 120, 121
Axilla Figs. 129–140
Axillary fold
anterior Figs. 78–80, 84, 86–90, 93–95, 123–126, 128, 130
posterior Figs. 78, 80, 86–89, 93–95, 123, 125, 126, 128,
130–132
Axillary region Fig. 127
Axillary space Figs. 130–134
Axis Figs. 57, 58
Azygos venous arch, node Figs. 100, 109
Bicipital aponeurosis Figs. 150, 153–160, 162
Bicipital sulcus
lateral Figs. 87–89, 152
medial Figs. 88, 89, 123, 128, 135–137, 143, 149, 152

- Brachial plexus Figs. 30–32, 127, 133, 139, 140
 communicating branch Figs. 27, 28
 lateral cord Figs. 127, 140
 medial cord Figs. 133, 140
 posterior cord Fig. 133
 Brachial vessels, vascular sheath Fig. 155
 Brachiocephalic trunk Figs. 108, 109, 113 I, 114, 115, 119
 Breast Figs. 86–95
 areola Figs. 82–84, 86–88, 92–95, 124, 125
 arterial ring Figs. 87, 88, 94
 female Figs. 86–95
 male Fig. 82
 nipple Figs. 78–84, 86–89, 92–95, 124, 125
 stroma Fig. 92
 Bronchial branch Figs. 109, 110
 Bulbar conjunctiva Fig. 51
 Bulbar septum Fig. 49
- Capitate bone Figs. 171, 197–201
 Cardiac apex Figs. 113 II, 116–119
 Cardiac branch, superior Fig. 22
 Cardiac notch Fig. 101
 Carotid
 bifurcation Figs. 8, 9, 13, 18, 28, 39
 body Figs. 15, 17
 sheath Figs. 8, 11, 12, 17, 18, 21, 24, 25
 triangle Figs. 8–15, 17, 18
 tubercle Figs. 16, 27, 29, 31, 32
 Carpal, intertendinous connective tissue Fig. 172
 Carpal tendon sheaths Figs. 172, 173
 flexor digitorum superficialis tendon to middle finger
 Fig. 172
 tendon for index finger Fig. 172
 Cauda equina Fig. 76
 Cerebellar peduncle
 inferior Fig. 60
 superior Fig. 60
 Cervical ganglion
 middle Figs. 27, 28
 superior Fig. 26
 Cervical region
 lateral Figs. 30–32
 median Figs. 2–9
 posterior Figs. 52–63
 Cervical regions Figs. 1–9, 30–32, 52–63
 Cervical vertebra, seventh (vertebra prominens) Figs. 52,
 54–58, 61–65, 67, 68
 Cervical vertebrae Figs. 16, 24, 60
 anterior, posterior tubercles Fig. 60
 Cheek Fig. 2
 Chin Figs. 2, 3
 Chorda tympani Fig. 45
 Chordae tendineae Fig. 118
 Choroid plexus Fig. 60
- Circulus venosus (Haller) Fig. 93
 Clavicle Figs. 1–3, 10, 19, 20, 29, 30, 31, 78–81, 86, 87, 91, 93, 108,
 109, 123, 124–126, 186
 acromial end Figs. 184, 187, 188
 body Figs. 184, 187, 188
 sternal articular surface Figs. 108, 109, 112, 113 I, 114, 115
 sternal end Figs. 2, 80, 81, 108
 Clavipectoral triangle Figs. 123–125, 135, 137, 138, 141
 Clunial branches, superior Figs. 72, 75
 Concha, eminence Fig. 63
 Condylar process Fig. 42
 Confluent sinus Fig. 60
 Conjunctiva, semilunar fold Fig. 51
 Conus
 arteriosus Figs. 112, 114–120, 122
 elasticus Figs. 4–9, 21, 22
 medullaris Fig. 76
 Coracoclavicular tract Figs. 19, 20, 23, 126, 139
 Coracoid process Figs. 126, 127, 139, 140, 184, 185, 187
 Cornea Fig. 51
 limbus Fig. 51
 Coronary sinus Figs. 113 I, 121
 orifice Fig. 122
 valve Fig. 122
 Coronary sulcus Figs. 112, 113 II, 115, 116, 118–122
 Coronoid process Figs. 42, 189, 191, 192
 Costal angle Figs. 72, 73
 Costal arch Figs. 78–82, 85, 99
 Costal bone Fig. 81
 Costal cartilage Figs. 80, 81, 84, 85
 Costal pleura Figs. 96, 98–100, 103–106, 108
 Costal tubercle Fig. 72
 Costodiaphragmatic recess Figs. 96, 98–100, 102–106, 113 II
 Costomediastinal recess Figs. 96, 98–100, 102–106, 111
 Cribriform plate (Eisler), axillary Fig. 129
 Cricoid cartilage, arch Figs. 5, 6, 9, 19
 Cubital fossa Figs. 149, 152
 Cusp
 anterior Fig. 118
 posterior Fig. 118
 Cutaneous retinacula Figs. 78, 82, 86, 88, 93, 130
- Deltoideopectoral sulcus Figs. 81, 93, 123, 124, 128
 Deltoideopectoral triangle (Mohrenheim) Figs. 19, 123–125
 Dermis Fig. 128
 Diaphragm Figs. 96–99, 100–103, 105, 106, 108–117
 costal part Figs. 111, 116, 117
 sternal part Figs. 111, 116, 117
 Diaphragmatic pleura Figs. 97–103, 105, 106, 108–110,
 112–116
 Digital skin cleft, proximal Fig. 166
 Dura mater
 cranial Figs. 48, 49
 spinal Figs. 60, 75–77

-
- Ear lobe Fig. 2
 Epicardium Figs. 116, 117
 Epiglottis Fig. 9
 Epistropheus Figs. 57, 58
 Esophagus Figs. 24–27, 29, 108–110
 Eustachian valve Fig. 122
 Extensor retinaculum Figs. 177, 180–182, 203, 205
 External occipital protuberance Figs. 52, 54–63
 Eye, globe Figs. 49, 51
- Falx cerebelli Fig. 60
 Falx cerebri Fig. 60
- Fascia
 antebrachial, superficial Figs. 150, 151, 153, 155, 156, 178–181
 axillary arch Figs. 129–132
 brachial arch Figs. 129–132
 brachial, deep Fig. 156
 brachial, superficial Figs. 129, 130–133, 135–139, 142–148, 150, 151, 153–157
 buccotemporal Fig. 42
 cervical, pretracheal layer Figs. 4, 5, 12–15, 18–26, 28–31
 cervical, superficial, angular tract Figs. 30, 32–34
 cervical, superficial layer Figs. 3–6, 8–16, 19, 30, 33, 34, 36, 37
 clavipectoral Figs. 84, 123–125, 127, 133, 134
 deep, axillary Figs. 129–132, 134, 135, 137, 140, 141
 deep cervical Figs. 16, 21, 23–26, 30
 deep cervical, intercarotid layer Figs. 16, 23–26
 deep cervical, prevertebral layer Figs. 25, 26, 29, 31
 endothoracic Fig. 110
 esophagus, visceral Fig. 110
 external intercostal Fig. 64
 external thoracic Fig. 68
 hand, deep dorsal Fig. 177
 hand, superficial dorsal Fig. 180
 infraspinous Figs. 64, 66–71
 lacrimal Fig. 50
 masseteric Figs. 35, 40
 middle cervical Figs. 4, 5, 12–15, 18–25, 28–31
 palmar, deep Fig. 173
 palmar, superficial Figs. 166, 168, 173
 parotid Figs. 1, 10, 11, 13, 16, 35
 parotid-masseteric Fig. 35
 subaxillary Fig. 134
 subcutaneous Figs. 83, 142
 subscapular Fig. 133
 superficial, axillary Figs. 90, 129, 130, 132, 133
 superficial cervical Figs. 1–6, 8–16, 19, 30, 33, 34, 36, 37
 superficial deltoid Fig. 123
 superficial pectoral Figs. 79, 80, 82, 85, 89–91, 123–125, 127, 129, 130, 132
 supraspinous Figs. 61, 62
 temporal Figs. 36, 40–44, 46–49
- Fascia
 temporal, deep layer Fig. 41
 temporal, superficial layer Figs. 36, 40, 41, 46, 47
 tenon's capsule, muscular Fig. 51
 thoracolumbar Figs. 64, 67–72, 75–77
- Fat pad (Bichat)
 buccal Figs. 33–37, 39–45, 49
 orbital process Fig. 42
 pterygoid process Fig. 43
 temporal process Figs. 42–45, 49
- Fat pad, axillary Figs. 80, 127, 130, 131, 135
- Fibrous sheath
 annular part Figs. 170, 172, 174–176
 cruciform part Figs. 170, 172–176
- Filum terminale Fig. 76
- Finger
 extensor aponeurosis Fig. 183
 index Figs. 169, 200
 little Figs. 169, 173
 middle Figs. 169, 200
 ring Fig. 169
- Flexor retinaculum Figs. 165, 169, 171–173, 176, 201
- Foramen magnum Figs. 59, 60
- Foramen ovale Fig. 44
- Forearm, interosseous membrane Figs. 180, 191, 192, 198, 201, 202, 204
- Fornix of conjunctiva, superior Fig. 51
- Fossa
 axillary Figs. 78–80, 86–90, 93–95, 123, 128, 129
 infraspinous Fig. 188
 infratemporal Figs. 43–45
 ovalis Fig. 122
- Galea aponeurotica Fig. 62
- Glenoid labrum Fig. 185
- Greater tuberosity, crest Figs. 185, 186
- Hamate bone Figs. 198, 199, 202, 204
 hook (Hamulus) Figs. 165, 171, 197, 201
- Hand Figs. 166–177, 182, 183
 digital fibrous sheath Fig. 167
 digital synovial sheath Fig. 176
 dorsal digital aponeurosis Figs. 182, 183
 dorsum Fig. 182
 palm Figs. 166–169, 171–173
- Heart Figs. 114–122
 anterior surface Figs. 113 II, 117
 diaphragmatic surface Figs. 117, 121, 122
 inferior surface Figs. 117, 121, 122
 left border Fig. 117
 pulmonary surface Fig. 117
 right border Figs. 113 II, 116, 122
 sternocostal surface Fig. 117

Humerus Figs. 66, 146–148, 157, 189, 190–195
 anatomic neck Figs. 184–187
 anterolateral surface Figs. 157, 189, 191, 194, 195
 anteromedial surface Figs. 189, 191, 192
 capitulum Figs. 162, 189, 191, 193–195
 greater tuberosity Figs. 184–186
 head Figs. 185–188
 lateral epicondyle Figs. 145, 146, 148, 178–181, 189–191, 193–195
 lesser tuberosity Figs. 184–187
 medial epicondyle Figs. 151–153, 161, 162, 189–193
 posterior surface Figs. 190, 192, 193
 shaft Figs. 66, 184, 186–188
 surgical neck Figs. 66, 184–188
 trochlea Figs. 189, 191–195
 ulnar groove Fig. 193
 subluxation Figs. 78, 79
 Hyoid bone Figs. 2–5, 14, 17, 18, 25–28, 39, 205
 body Figs. 6–9
 greater cornu Figs. 14, 17, 18, 25–28, 39

Iliac crest Figs. 72, 75, 76
 Iliac spine, posterior superior Figs. 69–71, 75, 76
 Inferior interpleural area Fig. 111
 Infraclavicular fossa Figs. 78, 80–82, 86–88, 91, 93–95, 129
 Infraclavicular region Figs. 123–127
 Infraglenoid tubercle Figs. 184–188
 Infraorbital margin Fig. 50
 Infrasternal angle Fig. 78
 Infratemporal crest Fig. 44
 Interatrial septum Figs. 121, 122
 Intercostal membrane
 external Figs. 84, 126
 internal Figs. 73, 74
 Intercostal spaces Figs. 64, 68, 80, 81, 109
 Interdigital fold Figs. 166–169
 Intermuscular aponeurosis Figs. 161, 162, 164
 septum Figs. 178–181
 Interpleural area, superior Figs. 104–106, 98, 99, 117
 Interscapular region Figs. 67, 68
 Intertendinous connection Figs. 177, 203, 205
 Intertubercular sulcus Fig. 184
 Intervenous tubercle Figs. 122
 Interventricular septum, muscular part Fig. 118
 Interventricular sulcus, anterior Figs. 113 II, 117–119
 Intervertebral disk Figs. 16, 24, 77, 108–110
 Intervertebral foramen Fig. 75
 Iris Fig. 51

Joint

acromioclavicular Figs. 62, 64, 65, 184, 187, 188
 articular capsule Figs. 184–186, 188–190, 192, 193, 196, 202, 204

Joint

articular capsule, distal radioulnar Figs. 196, 198, 202, 204
 articular capsule, elbow Figs. 189, 190, 192, 193
 articular capsule, fibrous membrane Fig. 184
 articular capsule, metacarpophalangeal Fig. 196
 articular capsule, shoulder Figs. 185, 186, 188
 carpometacarpal Figs. 196, 198, 204
 costochondral Fig. 84
 distal interphalangeal Figs. 183, 196, 197
 distal radioulnar Figs. 198, 199, 201, 202, 204
 elbow Figs. 189–195
 elbow, articular cavity Fig. 193
 elbow, fibrous membrane Figs. 189, 193
 elbow, synovial membrane Fig. 193
 hand Figs. 196–205
 head of rib Figs. 108, 109
 lumbosacral Fig. 76
 metacarpophalangeal Figs. 166, 176, 183, 196, 197, 202–204, 205
 metacarpophalangeal, little finger Figs. 166, 197, 205
 metacarpophalangeal, thumb Figs. 166, 196, 202, 203, 205
 metacarpophalangeal, thumb, sesamoid bones Figs. 196, 197
 midcarpal Fig. 196
 proximal interphalangeal Figs. 176, 183, 196, 197
 proximal radioulnar Fig. 193
 radiocarpal Figs. 201, 202
 radioulnar, distal Fig. 197
 shoulder Figs. 140, 184–188
 shoulder, axillary recess Fig. 186
 shoulder, capsule Fig. 140
 shoulder, fibrous membrane Fig. 185
 sternoclavicular Figs. 1, 3, 10, 14, 19, 20, 81, 90, 93, 94, 102, 124, 126, 127, 135–137
 sternocostal Figs. 81, 83, 84
 temporomandibular Figs. 41–45
 thumb, carpometacarpal Figs. 166, 196–202, 204
 thumb, interphalangeal Fig. 197
 vertebral Figs. 75, 77
 zygapophyseal, intervertebral Figs. 75–77
 Jugular arch Figs. 3, 4, 7, 19
 Jugular fossa Figs. 1, 2, 78, 79, 81, 86, 88

Koch's triangle Fig. 122

Lacertus fibrosus Figs. 150, 153–160, 162

Lacrimal bone Fig. 51

Lacrimal caruncle Fig. 51

Lacrimal crest

anterior Figs. 50, 51

posterior Figs. 50, 51

Lacrimal gland

orbital part Figs. 49, 50

palpebral part Fig. 49

Lacrimal punctum Fig. 51

accessory (variant) Fig. 51

Lacrimal sac Figs. 50, 51

Lactiferous duct Figs. 91, 92

Lactiferous sinus Fig. 92

Lambdoid suture Fig. 60

Lamellated corpuscles (Vater-Pacini bodies) Fig. 170

Lamina tragi Figs. 40, 42

Laryngeal inlet Fig. 9

Laryngeal prominence Figs. 6–8, 19–21, 23

Lateral antebrachial sulcus Figs. 150, 152, 155

Lateral facial region Figs. 40–42

Lateral palpebral commissure Fig. 51

Lateral pericardial node Fig. 100

Lesser omentum Fig. 111

Lesser tuberosity, crest Figs. 184, 185, 187

Ligament

acromioclavicular Figs. 186–188

anterior longitudinal Fig. 108

arteriosum (Botallo) Fig. 110

conoid Figs. 187, 188

coracoacromial Figs. 184, 185, 187

coracoclavicular Figs. 184, 185, 187, 188

coracohumeral Figs. 184–187

costotransverse Figs. 71–74

costotransverse, lateral Figs. 71–74

costotransverse, superior Figs. 73, 74

costoxiphoid Figs. 81, 83, 84, 85

cricotracheal Fig. 7

deep transverse metacarpal Figs. 197, 201, 202, 204

distal interphalangeal joint, collateral Fig. 197

dorsal arcuate carpal Figs. 196, 202, 204

dorsal carpal Figs. 177, 180–182, 203, 205

dorsal carpometacarpal Figs. 196, 202, 204, 206

dorsal intercarpal Figs. 196, 202, 204

elbow joint, collateral Fig. 191

falciform of liver Fig. 111

gastrosplenic Fig. 111

hepatogastric Fig. 111

iliolumbar Fig. 75

inferior glenohumeral Figs. 184, 185

inferior suspensory, breast Figs. 89–91

inferior suspensory, breast, lateral Figs. 89–91

inferior suspensory, breast, medial Fig. 91

inferior suspensory, breast, superior Fig. 91

inferior transverse scapular Fig. 186

innominate (Hyrtrl) Fig. 45

interclavicular Fig. 108

interphalangeal joint of thumb, collateral Fig. 197

interspinal Fig. 76

intertransverse Figs. 73–75

lateral thyroid Figs. 24, 27

Ligament

ligamentum flavum Figs. 75, 77

lumbocostal Fig. 75

medial palpebral Fig. 51

median cricothyroid Figs. 7, 8, 21, 22

median thyrohyoid Figs. 6, 7, 9

middle glenohumeral Figs. 184, 185, 187

natatory Fig. 167

nuchal Figs. 52, 54, 56, 59, 60, 62

oblique (Cooper) Figs. 191, 192

palmar Figs. 176, 197, 201

palmar arcuate carpal Fig. 197

palmar carpal Figs. 172, 173

palmar carpometacarpal Fig. 197

palmar radiocarpal Figs. 197, 201

palmar ulnocarpal Figs. 197, 201

pisohamate Figs. 197, 201

pisometacarpal Figs. 197, 201

posterior sternoclavicular Fig. 108

proximal interphalangeal joint collateral Figs. 196, 197

pterygospinal Figs. 44, 45

pulmonary Figs. 101, 105, 109

quadrate Fig. 189

radial annular Figs. 189, 191, 193–195

radial carpal Figs. 197, 201

radial carpal collateral Figs. 196, 198

radial collateral Figs. 189–191, 194, 195

radiate sternocostal Figs. 81, 83, 84

right phrenicopericardial (Tandler) Fig. 97

right phrenicopulmonary (Teutleben) Fig. 97

round of liver Fig. 111

sphenomandibular Figs. 44, 45

superficial transverse metacarpal Figs. 166, 167

superior glenohumeral Figs. 184, 185, 187

superior transverse scapular Figs. 185, 187, 188

suspensory, pyramidal lobe Fig. 7

transverse carpal Figs. 165, 169, 171, 176, 201

trapezoid Figs. 184, 185, 187, 188

ulnar carpal collateral Fig. 196

ulnar collateral Figs. 189–192

vaginal Fig. 175

vertebropleural Figs. 27, 29

volar carpal Figs. 166, 167

Linea alba Fig. 83

Lingular bronchus Fig. 107

Liver

inferior border Fig. 111

left lobe Fig. 111

right lobe Fig. 111

Lobar bronchus Figs. 107, 110

Lumbar aponeurosis Figs. 72, 75

Lumbar puncture Figs. 75, 76

Lumbar vertebrae Figs. 69–72, 75–77

costal process Fig. 75

spinous process Figs. 69–72, 75–77

Lunate bone Figs. 197, 198–201

Lung

anterior border Figs. 96–98, 101
anterior segment Figs. 101–103
apicoposterior segment Figs. 102, 103
diaphragmatic surface Figs. 97, 101
horizontal fissure Figs. 96, 97, 102, 111, 113 II
inferior border Fig. 97
interlobular septa Figs. 97, 101
interlobular surface Figs. 97, 101, 111
intersegmental septum Fig. 101
left Figs. 96, 98, 101–105, 111, 113 II
left, lingula Figs. 96, 101, 111
lingular segment Figs. 101–103
lobe, lower Figs. 96–99, 101–104, 111
lobe, middle Figs. 96–100, 102, 111, 113 II
lobe, upper Figs. 96, 98, 101, 104, 105, 111, 113 II
mediastinal surface Figs. 98, 101
oblique fissure Figs. 96–98, 100, 101–104, 111
right Figs. 96–100, 102, 104–106, 108, 109, 111, 113 II
root Figs. 97–106, 108, 110, 111

Lymph node

anterior mediastinal Figs. 99, 100, 108
apical Fig. 132
axillary Figs. 126, 129–132, 135–137
brachial Figs. 129–132, 135, 136
brachial, deep Figs. 129, 131
bronchopulmonary Fig. 100
central Figs. 129, 131, 136
deep cervical Figs. 8, 11–13, 29
deltoideopectoral Fig. 126
infra-auricular Figs. 12, 53, 127
infraclavicular Fig. 126
intercostal Fig. 109
interpectoral Fig. 136
jugulodigastric Figs. 8, 11, 12
jugulo-omohyoid Fig. 8
mastoid Fig. 53
nodus anguli anonymi Fig. 108
occipital Fig. 53
paramammary (Gerota) Figs. 136, 137
parasternal Fig. 85
paratracheal Figs. 24, 29, 100
pectoral Figs. 131, 136
pectoral (Sorgius) Figs. 126, 131
prevertebral Fig. 109
retroauricular Fig. 53
submandibular Fig. 34
subpectoral Figs. 136, 137
subscapular Figs. 129–132, 135–137
superficial cervical Figs. 10–12, 34
supraclavicular Fig. 29
tracheobronchial Figs. 99–104, 110
tracheobronchial, inferior Figs. 99, 100

Lymph node

tracheobronchial, superior Figs. 99, 100, 104

Lymphatic trunk, left jugular trunk Fig. 29

Main bronchus

left Figs. 105–107, 110
right Figs. 100, 106–109

Mamillary process Figs. 75–77

Mammary branches Figs. 82–84, 86–90, 92, 94, 95, 137

Mandible Figs. 2, 4, 33, 34, 42

oblique line Fig. 42

Mandible, neck Fig. 43

Mandibular angle Figs. 2, 3, 10, 14, 15, 33

Mandibular ramus Fig. 41

Manubrium sterni Figs. 2, 84, 96, 98–100, 102–106, 116, 117

Masseter plug Fig. 42

Masseteric branch Fig. 38

Mastectomy specimen Fig. 92

Mastoid process Figs. 10, 14, 18

Maxillary tuberosity Figs. 42, 44

Mediastinal pleura Figs. 96–106, 111–113 I, 114, 115

Mediastinum

posterior Figs. 108–110

superior Fig. 103

Meibom's glands Fig. 51

Mesotendineum Figs. 172, 173

variant Fig. 185

Metacarpal

base Figs. 177, 196, 198, 200, 202–205

bone Figs. 180, 198–200, 202–205

head Figs. 176, 177, 183, 196, 200–202

shaft Figs. 177, 196, 197, 200, 202

styloid process Figs. 199, 202, 204

Mitral valve Fig. 119

anterior cusp Fig. 119

anterolateral commissure Fig. 119

posterior cusp Figs. 119, 121

Monticulus Fig. 166

Muscle

abductor digiti minimi Figs. 165, 168, 169, 172, 177

abductor pollicis brevis Figs. 165, 167–169, 171–173

abductor pollicis brevis, deep part Fig. 168

abductor pollicis brevis, superficial part Fig. 168

abductor pollicis longus Figs. 165, 171–173, 177–182

adductor pollicis Figs. 171–173, 203, 205

adductor pollicis, transverse head Figs. 172, 173

anterior auricular Figs. 41, 46, 47

anterior papillary Figs. 118–120

biceps brachii Figs. 128, 130–132, 134–144, 150–158, 161–164, 184–186, 188

biceps brachii, long head Fig. 188

biceps brachii, short head Figs. 130–132, 134–141

biceps brachii, tendon of long head Figs. 184–186

brachialis Figs. 144, 150, 154–157, 160, 161, 164

Muscle

brachioradialis Figs. 146–164
 buccinator Figs. 38, 42–44
 common head of flexor Figs. 150, 151, 155, 156, 164
 constrictor pharyngis inferior Figs. 14, 17, 18, 21, 24–26, 28
 constrictor pharyngis inferior, thyropharyngeal part Figs. 14, 18, 21
 coracobrachialis Figs. 125, 126, 129, 133, 134, 137, 138, 140, 141, 143, 144
 cricothyroid Figs. 5–9, 21, 22
 deltoid Figs. 19, 20, 62, 64–66, 86–89, 123–128, 130, 131, 134, 135, 137–141, 145, 146
 deltoid, clavicular part Fig. 131
 deltoid, epimysium Figs. 124, 127
 deltoid, spinal part Fig. 66
 depressor anguli oris Figs. 35–39, 42, 44
 depressor labii inferioris Fig. 35
 digastric Figs. 11, 17, 18, 25–28, 33, 34, 38–45
 digastric, anterior belly Figs. 17, 18, 33, 34
 digastric, intermediate tendon Fig. 11
 digastric, posterior belly Figs. 8, 12–18, 25–28, 39, 40, 43–45
 dorsal interosseous Figs. 167, 175, 177, 182, 183, 203, 205
 extensor carpi radialis Fig. 147
 extensor carpi radialis brevis Figs. 157, 159–163, 177–182, 2–3, 205
 extensor carpi radialis longus Figs. 146, 148, 159–164, 177, 180, 182, 203, 205
 extensor carpi ulnaris Figs. 159, 177–182
 extensor digiti minimi Figs. 177–182, 203, 205
 extensor digitorum Figs. 159, 160, 177–183, 203, 205
 extensor indicis Figs. 177, 179, 180–182, 203, 205
 extensor pollicis brevis Figs. 165, 172, 173, 177, 179–182, 203
 extensor pollicis longus Figs. 177, 179–182, 203, 205
 fascia of serratus anterior Figs. 129, 134–136, 141
 fascial slip of rectus lateralis Fig. 49
 flexor carpi radialis Figs. 155, 156, 158–165, 171–173
 flexor carpi ulnaris Figs. 152, 155, 158, 160–162, 165, 171–173
 flexor digiti minimi brevis Figs. 165, 168, 169, 172, 175
 flexor digitorum profundus Figs. 158, 159, 163, 164, 167, 170–176
 flexor digitorum superficialis Figs. 158–165, 167, 169, 171–176
 flexor digitorum superficialis, humeroulnar head Figs. 157, 160–164
 flexor digitorum superficialis, radial head Figs. 158–164, 171, 172
 flexor pollicis brevis Figs. 165, 167–169, 171–175
 flexor pollicis brevis, superficial head Figs. 165, 167–169, 171, 172, 174, 175
 flexor pollicis longus Figs. 158–164, 171, 172
 frontalis Fig. 42

Muscle

hyoglossus Figs. 14, 25, 26, 34
 hypothenar Figs. 166, 173
 iliocostalis Figs. 54–58, 63, 70–73, 76, 77
 iliocostalis cervicis Figs. 54–58, 63
 infraspinatus Figs. 64, 66
 intercostal Fig. 68, 98
 intercostalis externus Figs. 64, 68, 72–74, 84, 85, 109, 126, 137, 138
 intercostalis internus Figs. 74, 84, 85, 109, 126
 intercostalis intimus Figs. 74, 109
 interspinous Fig. 57
 intertransverse Figs. 73, 75
 lateral lumbar intertransverse Fig. 75
 lateral pterygoid Figs. 43, 44
 lateral rectus (eye) Fig. 49
 latissimus dorsi Figs. 64–71, 76, 77, 129, 130, 132–141, 144
 levator costae Figs. 72–74
 levator costae brevis Figs. 72–74
 levator costae longus Figs. 72, 73
 levator palpebrae superioris Figs. 49–51
 levator scapulae Figs. 31, 32, 54–60, 62, 63, 65, 67, 68, 70, 71
 longissimus Figs. 70–72
 longissimus capitis Figs. 55–59, 62, 63
 longissimus cervicis Figs. 55, 57, 58
 longissimus thoracis Figs. 54–56, 58, 73, 76, 77
 longus capitis Figs. 16, 17, 24–26, 28, 31
 longus colli Figs. 16, 21, 23–26
 lumbrical, first Figs. 165, 167–170, 172–176
 lumbrical, fourth Figs. 165, 169, 172, 174
 lumbrical, second Figs. 171, 174, 176
 lumbrical, third Figs. 171, 174–176
 masseter Figs. 17, 18, 33–39, 41, 42–44
 masseter, deep part Fig. 41
 masseter, superficial part Fig. 41
 medial lumbar intertransverse Fig. 75
 medial pterygoid Fig. 44
 multifidus Figs. 60, 76, 77
 mylohyoid Figs. 17, 18, 33, 34, 38, 39
 obliquus capitis inferior Figs. 59, 60
 obliquus capitis superior Figs. 58, 59
 obliquus externus abdominis Figs. 72, 75, 79, 80, 83, 84, 98, 99
 obliquus internus abdominis Figs. 70–72, 75–77
 occipitofrontalis, frontal belly Figs. 41, 42
 occipitofrontalis, occipital belly Figs. 52, 54, 56, 57, 59–63
 omohyoid Figs. 6, 8–18, 20–26, 28–34, 79, 81
 omohyoid, inferior belly Figs. 9, 18, 29, 31, 32
 omohyoid, superior belly Figs. 8, 9, 11–14, 18
 opponens pollicis Figs. 168, 169
 orbicularis oculi, orbital part Figs. 35–38, 41, 46–48
 orbicularis oris Fig. 35
 palmar interosseous, second Fig. 171

Muscle

palmaris brevis Figs. 166–168
 palmaris longus Figs. 158, 159, 166, 167
 pectinate Figs. 121, 122
 pectoralis major Figs. 19–21, 23, 79–81, 83, 84, 87, 89–91, 99, 100, 104, 106, 123–127, 129, 130–132, 134–141
 pectoralis major, abdominal part Figs. 80, 83, 139
 pectoralis major, clavicular part Figs. 19–21, 23, 80, 81, 124–127, 135–139
 pectoralis major, sternocostal part Figs. 19, 23, 80, 83, 84, 124–127, 135–139
 pectoralis minor Figs. 84, 99, 100, 106, 125–127, 134, 137–140
 posterior auricular Figs. 52, 53, 61, 62
 posterior papillary Fig. 119
 pronator quadratus Fig. 163
 pronator teres Figs. 150, 152–164
 pronator teres, humeral head Figs. 157, 160–164
 pronator teres, ulnar head Figs. 157, 160–163
 psoas major Fig. 75
 quadratus labii inferioris Fig. 35
 rectus abdominis Figs. 80, 81, 84, 85, 96, 98, 99, 116, 117
 rectus capitis posterior major Figs. 58–60
 rectus capitis posterior minor Figs. 58–60
 rhomboideus major Figs. 55, 58, 62, 64–70
 rhomboideus minor Figs. 62, 65, 67, 68
 risorius Figs. 35–38
 scalenus anterior Figs. 27–32
 scalenus medius Figs. 16, 29–32, 63
 scalenus posterior Figs. 32, 63
 semispinalis capitis Figs. 54–59, 62, 63
 semispinalis cervicis Figs. 57–60
 semispinalis thoracis Fig. 57
 serratus anterior Figs. 31, 32, 80, 95, 129, 131–141
 serratus posterior inferior Figs. 54, 62, 63, 68, 70, 71, 76, 77
 sheath of superior rectus Fig. 51
 spinalis thoracis Figs. 70–73, 76, 77
 splenius capitis Figs. 31, 32, 52–63
 splenius cervicis Figs. 54–58, 62, 63, 70, 71
 sternocleidomastoid Figs. 1–34, 36, 37, 41, 43, 44, 52–59, 60–63, 65, 78–81, 83, 84, 86–88, 91, 96, 98, 103–106, 116, 123, 126
 sternocleidomastoid, clavicular head Figs. 17, 20–23
 sternocleidomastoid, sternal head Figs. 1, 19–24, 80, 81, 83, 84, 96, 103–106, 126
 sternohyoid Figs. 2–9, 12–15, 21–26, 28, 29, 33, 34
 sternothyroid Figs. 2, 4–9, 20–22, 25, 26, 28
 styloglossus Figs. 15, 40
 stylohyoid Figs. 13, 15, 17, 18, 25–28, 40, 43–45
 stylopharyngeus Fig. 40
 subclavius Figs. 126, 127
 subscapularis Figs. 131–134, 137, 139–141
 superior auricular Figs. 41, 46, 48, 52, 53, 59, 61–63
 superior oblique, trochlea Fig. 51

Muscle

superior rectus (eye) Figs. 49, 51
 supinator Figs. 156, 157, 159–164, 180, 181
 supinator, deep layer Figs. 180, 181
 supraspinatus Figs. 54, 55, 63, 65, 67, 68, 71
 temporalis Figs. 42–45, 47–49
 temporoparietal branch (facial nerve) Fig. 46
 temporoparietalis Figs. 41, 46–48
 tendinous intersection of sternohyoid Figs. 4–6, 8
 tendinous intersection of sternothyroid Figs. 6, 7
 tensor semivaginae of scapulohumeral joint Fig. 127
 tensor veli palatini Figs. 44, 45
 teres major Figs. 64, 66–71, 132–134, 138–140, 144
 teres minor Figs. 64, 66
 thyrohyoid Figs. 7, 17–19, 21–24, 26–28
 transversus abdominis Figs. 102, 103
 transversus nuchae Fig. 52
 transversus thoracis Fig. 85
 trapezius Figs. 30–32, 52–55, 58, 61–71, 76, 77, 81, 86, 88, 89, 91, 123, 124, 135, 136
 trapezius, ascending part Figs. 61, 62, 64, 65
 trapezius, descending part Figs. 52, 61, 64, 65
 trapezius, transverse part Figs. 61, 62, 64, 65
 triangularis Figs. 35–39, 42, 44
 triceps brachii Figs. 66, 132, 133, 141, 144–148, 153
 triceps brachii, lateral head Figs. 66, 144–148
 triceps brachii, long head Figs. 66, 132, 133, 140–148
 triceps brachii, medial head Figs. 141, 144–148, 153
 zygomaticus major Figs. 35–38
 zygomaticus minor Fig. 35

Myocardium Figs. 118, 119

Nail bed, dorsal anastomotic branch Fig. 170

Nail fold Fig. 183

Nasal branch, lateral Fig. 41

Natatory fold Figs. 166–169

Neck, linea alba Figs. 2, 4, 19–24

Nerve

accessory Figs. 8, 14–18, 30–32, 39, 54, 55, 58, 62, 63, 65–68, 70
 anterior pectoral Figs. 126, 127, 134
 auriculotemporal Figs. 18, 36–43, 45–48
 axillary Figs. 66, 133, 134, 139, 140
 buccal Figs. 42, 43, 45
 cervical, dorsal rami Fig. 52
 cervical, second Fig. 60
 cervical, third, anterior branch Figs. 16, 31, 32, 60
 cervical, third, posterior branch Fig. 54
 cervical, third, sternocleidomastoid branch of Fig. 18
 cervical, fourth, anterior branch Fig. 31
 cervical, fourth, posterior branch Figs. 55, 57, 63
 cervical, fifth Figs. 31, 32, 55, 58
 cervical, fifth, anterior branch Fig. 32
 cervical, fifth, posterior branch Figs. 55, 58

Nerve

cervical, sixth, posterior branch Fig. 55
 cervical, seventh, posterior branch Fig. 55
 cervical, eighth, posterior branch Fig. 58
 ciliary Fig. 49
 common digital Figs. 165, 168–171
 deep temporal, anterior Figs. 43, 45
 deep temporal, middle Figs. 43, 45
 deep temporal, posterior Fig. 43
 dorsal scapular Figs. 31, 32, 54, 55, 58, 62, 63, 65, 67, 68, 70
 facial Figs. 1, 10–12, 14–18, 33, 34, 36–40, 46–48, 62, 63
 facial, buccal branch Figs. 33, 34, 36–38, 40
 facial, cervical branch Figs. 1, 10–12, 14–16, 33, 34, 36–38, 40
 facial, cervicofacial branch Figs. 38–40
 facial, communicating branch Fig. 38
 facial, inferior branch (cervicofacial branch) Figs. 38–40
 facial, marginal mandibular branch Figs. 33, 34, 36–38, 40
 facial, posterior auricular Fig. 40
 facial, superior branch (temporofacial branch) Figs. 38, 39
 facial, temporal branch Figs. 36–38, 40, 46–48
 facial, temporofacial branch Figs. 39, 40
 facial, zygomatic branches Figs. 36–40
 great auricular Figs. 1, 15, 38, 52, 53, 58, 65
 great auricular, anterior branch Figs. 1, 30–37, 53
 great auricular, posterior branch Figs. 1, 30–32, 35, 36, 53, 59, 61–63
 greater occipital Figs. 52–63
 greater splanchnic Fig. 110
 hypoglossal Figs. 9, 11–15, 17, 18, 25–29, 34, 38, 39
 hypoglossal, descending branch Figs. 8, 9, 12–14, 17, 18, 25, 28
 inferior alveolar Figs. 43, 45
 inferior cervical cardiac Fig. 28
 inferior laryngeal Figs. 24, 26
 inferior lateral brachial cutaneous Fig. 148
 infratrochlear Fig. 50
 intercostal Figs. 74, 80, 83–85, 109, 110, 134, 138
 intercostal, lateral cutaneous branches Figs. 74, 80, 130–132, 134–137, 140, 141
 intercostal, posterior branch Figs. 73, 74
 intercostobrachial Figs. 129–133, 135–139, 141–143
 lacrimal Fig. 49
 lateral antebrachial cutaneous Figs. 142, 150, 154–160, 164
 lateral pectoral Figs. 125–127, 134
 lesser occipital Figs. 31, 32, 52–63
 lesser occipital, second Fig. 52
 lingual Figs. 34, 43, 45
 long thoracic Figs. 31, 32, 63, 133, 134, 137–141
 lumbar Figs. 71, 72, 75, 77
 lumbar, lateral posterior branch Fig. 72
 lumbar, posterior branch Fig. 75
 lumbar, posterior root Fig. 77

Nerve

masseteric Figs. 42, 43, 45
 medial antebrachial cutaneous Figs. 134, 139–144
 medial antebrachial cutaneous, anterior branch Figs. 150, 151, 153–160
 medial antebrachial cutaneous, brachial cutaneous branch Figs. 134, 140, 142–144
 medial antebrachial cutaneous, posterior branch Figs. 150, 153, 154, 156, 157
 medial brachial cutaneous Figs. 128–130, 132–134, 137, 138, 140–144
 medial pectoral Figs. 126, 127, 138, 139
 medial pterygoid Fig. 45
 medial supraclavicular Figs. 1, 20, 83
 median Figs. 127, 133, 134, 138–141, 143–145, 157–165, 169, 171, 173
 median, lateral root Figs. 133, 138
 median, medial root Figs. 133, 138
 median, muscular branch Figs. 160, 167–169, 171, 173
 median roots, union of Figs. 139, 140
 middle cervical cardiac Figs. 27, 28
 musculocutaneous Figs. 127, 139–141
 mylohyoid Figs. 34, 38, 43
 occipital, third Figs. 52, 54–57, 60–63
 optic Fig. 49
 parotid gland Figs. 3, 11–17, 25, 26, 32, 33–39
 parotid gland, cervical lobe Figs. 3, 11–16, 32
 parotid gland, deep part Figs. 17, 34, 38, 39
 parotid gland, superficial part Figs. 17, 38, 39
 parotid gland, supply Fig. 38
 phrenic Figs. 30–32, 98–106, 108–110
 posterior antebrachial cutaneous Figs. 145–148, 180
 posterior antebrachial interosseous Fig. 180
 posterior auricular branch of facial Figs. 52, 53
 posterior brachial cutaneous Figs. 66, 141
 posterior pectoral Figs. 126, 127, 138, 139
 posterior root of lumbar Fig. 77
 posterior superior alveolar Fig. 45
 proper palmar digital Figs. 165, 167–171, 174, 175
 proper palmar digital, dorsal branch Figs. 170, 174
 radial Figs. 66, 133, 140, 141, 144, 146–148, 156, 157, 160–164
 radial, deep branch Figs. 156, 157, 159, 161–164, 180, 181
 radial, muscular branches Figs. 140, 144, 148, 161–164
 radial, superficial branch Figs. 156–164, 182
 radial, ulnar collateral branch Fig. 144
 recurrent laryngeal Figs. 23–28, 110
 recurrent laryngeal, esophageal branch Fig. 24
 recurrent laryngeal, pharyngeal branch Fig. 26
 recurrent laryngeal, tracheal branch Figs. 24, 26
 root of spinal Fig. 77
 sacral, first, dorsal ramus Fig. 75
 suboccipital Figs. 59, 60
 subscapular Figs. 131–134, 139, 140
 sulcus of spinal Fig. 60

Nerve

- superior laryngeal, external branch Figs. 14, 15, 17, 18, 22, 24, 26, 27
- superior laryngeal, internal branch Figs. 14, 15, 17, 18, 27, 28
- superior lateral brachial cutaneous Fig. 66
- supraclavicular Figs. 30–32
- supraorbital Fig. 50
- suprascapular Figs. 32, 55
- suprasternal Figs. 1, 20, 32
- supratrochlear Fig. 50
- thoracic Figs. 54, 58, 61, 64, 67–74, 77
- thoracic, medial posterior cutaneous branch Fig. 58
- thoracic, posterior branch Figs. 54, 61, 74, 75
- thoracic, posterior cutaneous branch Figs. 64, 73, 74
- thoracodorsal Figs. 132–134, 138, 139–141
- transverse cervical Figs. 1, 10, 30, 31, 33, 34, 36
- transverse cervical, inferior branch Fig. 31
- transverse cervical, superior branches Figs. 10, 31
- ulnar Figs. 139–141, 144, 158, 159, 165, 168, 169, 171, 173
- ulnar collateral branch of radial Fig. 144
- ulnar, deep branch Figs. 165, 171
- ulnar, dorsal branch Fig. 159
- ulnar, proper palmar digital branch for little finger Fig. 165
- ulnar, superficial branch Figs. 165, 169
- vagus Figs. 9, 12, 13, 15, 17, 18, 23, 25–28, 103, 105, 106, 108–110
- vagus, bronchial branches Figs. 108, 109
- vagus, superior cardiac branch Fig. 23
- vena comitans of hypoglossal Fig. 34
- zygomatic, communicating branch Fig. 49

Neurovascular bundle Figs. 135, 137

Nuchal line

- inferior Fig. 59
- superior Figs. 52, 56, 59
- supreme Figs. 52, 56, 59, 62

Nuchal plane Fig. 59

Oblique cord Figs. 164, 191, 192

Occipital anastomosis Fig. 58

Occipital bone Figs. 59, 60

occipital squama Fig. 59

Occipital plane Figs. 52, 54–56

Occipital region Figs. 50–60

Occipital squama Figs. 55, 56

Olecranon Figs. 146, 148, 191–195

Olecranon fossa Figs. 190, 193

Oral commissure Fig. 2

Orbit Fig. 49

Orbital fat Figs. 49, 50

Orbital septum Fig. 50

Oval fossa, limbus Fig. 122

Palmar aponeurosis Figs. 166–168

longitudinal fascicles Figs. 166–168

transverse fascicles Figs. 166, 168

Palmar arch

deep Figs. 171, 173

superficial Figs. 165, 168–170, 172, 174, 175

Palpebral arch

inferior Fig. 50

superior Fig. 50

Palpebral limbus, posterior Fig. 51

Parathyroid gland

inferior Figs. 23–26

superior Figs. 23–26

Parietal peritoneum Fig. 97

Parietal pleura Figs. 74, 85, 108, 116

costal part Fig. 116

Parotid duct (Steno) Figs. 33, 36–38, 40–42

Parotid gland, accessory Figs. 35–39, 41

Parotid-masseteric region Figs. 35–39

Pectoral region Figs. 78–85

Perforating branches Figs. 85, 87–92, 94, 95, 135

Pericardiacophrenic vessels Figs. 101, 104

Pericardial capsule Figs. 105, 112, 114, 115

Pericardial cavity Figs. 112, 113

Pericardial pleura Fig. 111

Pericardium Figs. 96, 97, 100–106, 110–112, 113 I–117, 121, 122

diaphragmatic part Figs. 110, 112, 113 II–115, 117

dome Fig. 112

lateral part Figs. 112, 113 II–117

sternocostal part Figs. 112, 113 II–117

Pericranium Figs. 47, 48, 59, 60

Perimysium Fig. 124

Periorbita Fig. 49

Peritendineum Fig. 172

Phalanx

distal Figs. 183, 196, 170

distal, base Fig. 183

distal, periosteum Fig. 174

distal, tuberosity Figs. 196, 197

middle Figs. 183, 196, 197, 200

middle, base Fig. 183

middle, trochlea Figs. 196, 197

proximal Figs. 169, 196, 197, 200

proximal, base Figs. 169, 170, 183, 196, 197

proximal, thumb Figs. 169, 200

proximal, trochlea Figs. 196, 197

Phrenicomedial recess Figs. 96–106, 111, 113 II

Pisiform bone Figs. 165, 166, 197, 201

Planum cardiacum Figs. 111, 115, 117

Platysma Figs. 1–3, 9–14, 19, 35, 36, 83

Pleural capsule Figs. 101, 108

Pleural fat, folds Figs. 96, 98–106, 111, 113 II

Plexus

cervical Figs. 31, 32, 62, 63

esophageal Figs. 108–110

Plexus

- lumbar Fig. 75
- trapezian branch Figs. 31, 32
- Pontine cerebellar peduncle Fig. 60
- Posterior brachial region Figs. 145–148
- Pterygoid process, lateral plate Fig. 44
- Pterygopalatine foramen Fig. 44
- Pterygospinal foramen Figs. 44, 45
- Pterygospinous process Fig. 44
- Pulmonary hilum Figs. 98, 99, 104, 106
- Pulmonary sulcus Figs. 108, 110
- Pulmonary trunk Figs. 105, 112, 113 I, 115, 117–120, 122
- Pulmonary valve Figs. 118–120, 122
 - anterior cusp Figs. 120, 122
 - left cusp Figs. 118–120, 122
- Pulmonary valve, right cusp Figs. 118–120, 122
- Punctum nervosum Fig. 1
- Puncture
 - elbow joint Figs. 187, 188
 - midcarpal joint Figs. 204, 205
 - radiocarpal joint Figs. 202–205
 - shoulder joint Figs. 187, 188
- Pylorus Fig. 111
- Pyramid of vermis Fig. 60

Radial carpal sac Fig. 172

Radial tuberosity Figs. 164, 189, 191, 193–195

Radius Figs. 163, 177, 179, 180, 189, 191, 192, 194, 195, 198–201, 202, 204

carpal articular surface Fig. 198

dorsal tubercle Figs. 177, 196, 199, 200, 202, 204

fovea Fig. 193

head Figs. 189, 193–195

neck Figs. 189, 191, 192

shaft Figs. 191–195

styloid process Figs. 196, 198, 199–202, 204

Rectus sheath Figs. 78–81, 83–85

anterior layer Figs. 81, 84, 85

Region

antebrachial Figs. 158–164, 179–181

anterior antebrachial Fig. 158

anterior carpal Fig. 165

anterior cubital Figs. 150–157

axillary Fig. 127

cervical Figs. 1–9, 30–32, 52–63

infraclavicular Figs. 123–127

interscapular Figs. 67, 68

lateral cervical Figs. 30–32

lateral facial Figs. 40–42

median cervical Figs. 2–9

occipital Figs. 50–60

parotid-masseteric Figs. 35–39

pectoral Figs. 78–85

posterior antebrachial Figs. 178–181

Region

posterior brachial Figs. 145–148

posterior cervical Figs. 52–63

retromandibular fossa Figs. 14, 40

scapular Fig. 66

sternocleidomastoid Figs. 8, 9

suprascapular Figs. 61–63, 65–68

temporal Figs. 41, 42, 49

thyroid Figs. 19–28

vertebral (lumbar part) Fig. 77

vertebrothoracic Figs. 72, 75

Retropharyngeal space Fig. 27

Retrosternal fat pad Figs. 96, 104–106, 111

Rhomboid fossa Fig. 60

Rib

first Figs. 19, 20, 63, 84, 85, 112, 123, 126

first, sternocostal synchondrosis Figs. 84, 85

second Figs. 63, 99, 113 I, 137, 138

third Figs. 63, 81, 84, 137, 138

fourth Figs. 68, 79, 81, 84, 85, 113 II

fifth Fig. 79

sixth Figs. 71, 79, 81

seventh Fig. 81

seventh, neck Fig. 74

eighth Figs. 64, 72

ninth Figs. 72, 73

tenth Fig. 71

eleventh Figs. 70, 72, 73

twelfth Figs. 72, 75

shaft Figs. 72, 110

Sacciform recess Figs. 189–191, 194, 195

Sacral crest, median Fig. 75

Sagittal sinus, superior Fig. 60

Sappey's Terry: Fig. 113 I

Scalenovertebral triangle Figs. 27–29

Scalp Figs. 54, 55, 59

Scaphoid bone Figs. 196, 198, 199, 202, 204

tubercle Figs. 199, 201, 204

Scapula, inferior angle Figs. 54, 55, 63–67, 69, 84, 184–188

costal surface Figs. 184, 185, 187

glenoid cavity Figs. 184, 185

inferior angle Fig. 184

lateral border Figs. 184, 188

medial border Figs. 54, 55, 64–67, 69, 184, 186, 187

neck Figs. 184–188

superior angle Figs. 54, 55, 63, 65

superior border Figs. 65, 185, 187, 188

Scapular region Fig. 66

Scapular spine Figs. 54, 55, 62–71, 184–188

spinous tubercle Figs. 64–71

Segmental bronchus Fig. 107

Semilunar cusps Fig. 122

Septal cusp Figs. 118, 121, 122

-
- Septomarginal trabecula Figs. 118, 119
- Sigmoid sinus Fig. 60
- Sinoatrial node (sinus node of Keith-Flack) Fig. 122
- Skin Figs. 2, 3, 59, 61, 82, 83, 123–125, 128, 145, 152
- Sphenofrontal suture Fig. 49
- Sphenoid bone
- greater wing Figs. 47, 49
 - spine Figs. 44, 45
- Sphenosquamous suture Figs. 47–49
- Spinal ganglion Fig. 60
- Spinal roots, dural sheath Fig. 77
- Spinous process Figs. 57, 58, 61, 62, 64, 65, 67–74, 77
- Splenic omentum Fig. 111
- Sternal angle (Ludwig) Figs. 81, 83, 85
- Sternal branch Fig. 85
- Sternal membrane Figs. 80, 81, 83, 84, 135–139
- Sternocleidomastoid region Figs. 8, 9
- Sternum Figs. 2, 79, 84, 96, 98–100, 102–106, 116, 117
- Jugular notch Fig. 102
- Sternum, jugular notch Figs. 1–7, 19–23, 96
- Stomach
- fundus Fig. 111
 - greater curvature Fig. 111
 - lesser curvature Fig. 111
- Stratum subcutaneum, deep layer Figs. 1, 13, 15, 46, 48, 79, 80, 82, 83, 89–91, 123–125, 127, 142, 143, 151, 152, 155, 156, 178–181
- Styloid process
- metacarpal bone) Figs. 196, 199, 202, 204
 - radius Figs. 163, 165, 196, 198–202, 204
 - temporal bone Figs. 18, 40, 41, 43–45
 - ulna Figs. 177, 196–199, 201, 202, 204
- Subcutaneous fat Fig. 78
- Subcutaneous tissue Figs. 1–3, 10, 11, 36, 59, 61, 80, 82, 83, 86, 87, 89, 90–95, 123–125, 128–130, 142, 143, 145, 152, 155, 166, 168, 178, 181
- Subdeltoid space Fig. 127
- Subgaleatic space Fig. 59
- Sublingual gland Fig. 34
- Submandibular duct (Wharton) Figs. 34, 38
- Submandibular ganglion Fig. 34
- Submandibular gland Figs. 8, 9, 17, 18, 33, 34, 38, 39
- Submandibular triangle Figs. 33, 34
- Submental triangle Fig. 3
- Suboccipital puncture Figs. 59, 60
- Subpleural fatty layer Fig. 97
- Sulcus terminalis Fig. 121
- Supinator crest Figs. 191, 194, 195
- Supraclavicular fossa
- greater Figs. 2, 21, 22, 79, 81, 86–88, 91, 108, 123, 135, 136
- Supraclavicular fossa
- lesser Figs. 78, 79, 81, 123
- Supracondylar crest
- lateral Figs. 189–191, 194, 195
 - medial Figs. 189, 190, 192
- Supraglenoid tubercle Fig. 185
- Supraorbital margin Fig. 50
- Suprascapular region Figs. 61–63, 65–68
- Supraspinous fossa Figs. 185, 188
- Suprasternal space Fig. 3
- Supraventricular crest Figs. 118, 119
- Sweat glands, apocrine Fig. 128
- Sympathetic trunk Figs. 15, 16, 23, 25–29, 108–110
- communicating branch Figs. 109, 110
- Tarsal glands Fig. 51
- Tarsus
- inferior Fig. 50
 - superior Figs. 50, 51
- Temporal bone Figs. 42–45, 47, 48
- squamous part Figs. 47, 48
- Temporal region Figs. 41, 42, 49
- Tendon canal, flexor carpi radialis, Figs. 197, 201
- Tendon sheath
- common flexor Figs. 165, 169, 172, 173
 - compartments Fig. 177
 - digital Figs. 167, 172–175, 197
 - extensor digitorum and extensor indicis Figs. 177, 182, 203, 205
 - intertubercular Figs. 185, 188
 - little finger, extensor Figs. 177, 182, 203, 205
 - radial carpal extensor Figs. 177, 182, 203, 205
 - radial carpal flexor Fig. 165
 - thumb, abductor longus and extensor brevis Figs. 165, 203, 205
 - thumb, long extensor Figs. 177, 182, 203, 205
 - thumb, long flexor Fig. 172
 - tendinous chiasm Figs. 174–176
- Tenon's capsule Fig. 49
- muscle sheath Fig. 49
- Terminal crest Figs. 121, 122
- Thebesian valve Fig. 122
- Thenar Fig. 166
- Thoracic cavity Figs. 96, 98–100, 102–106
- Thoracic duct Figs. 29, 108–110
- Thoracic vertebrae Figs. 56, 58, 60–62, 64, 65, 67–69, 70–74
- spinous process Figs. 56, 58, 60–62, 64, 65, 67–69, 70–74
 - transverse process Figs. 58, 60, 73, 74
- Thorax, dorsum Figs. 64–74
- Thymic vessels Fig. 101
- Thymus Figs. 96, 102, 106
- Thyrocervical trunk Fig. 32
- Thyroglossal duct Fig. 7
- Thyrohyoid branch Fig. 14
- Thyrohyoid membrane Figs. 7, 9, 14, 17, 25
- Thyroid cartilage Figs. 5, 9, 24
- Thyroid gland Figs. 7–9, 12–15, 19, 23–28
- accessory Figs. 6–8
 - fibrous capsule Figs. 8, 9
 - inferior pole Fig. 24

Thyroid gland

- isthmus Figs. 4–9, 19, 21, 22
- superficial pole Figs. 23, 24
- Thyroid notch, superior Figs. 5, 22
- Thyroid plexus unpaired Figs. 21–24, 26, 28, 108, 109
- Thyroid region Figs. 19–28
- Thyroid tubercle, inferior Fig. 7
- Thyrolingual trunk Fig. 9
- Thyrolinguofacial trunk Figs. 11–13, 16
- Tonsillar branch Fig. 34
- Trabeculae carnae Figs. 118, 119, 122
- Trachea Figs. 4–9, 21–28, 107–110, 113 I, 114, 115
 - bifurcation Fig. 107
 - cartilage Figs. 6, 7, 9
- Transverse sinus Fig. 60
- Trapezian branch Figs. 62, 63
- Trapezium, tubercle Figs. 197, 201
- Trapezoid bone Figs. 198–200, 202, 204
- Triangular disc Fig. 198
- Tricuspid valve Figs. 119, 121, 122
 - anteroposterior commissure Figs. 118, 119
 - anterior cusp Figs. 119, 121
 - posterior cusp Figs. 119, 121
 - posteroseptal commissure Fig. 119
- Triquetral bone Figs. 196, 198, 199, 202, 204

Ulna Figs. 177, 189–199, 201, 202, 204

- carpal canal Fig. 168
- carpal sac Figs. 172, 173
- head Figs. 196, 198, 202, 204
- nutrient foramen Fig. 189
- radial notch Figs. 190–193
- styloid process Figs. 177, 196–199, 201, 202, 204
- subcutaneous part Figs. 190, 193–195
- trochlear notch Figs. 190–195
- tuberosity Figs. 189, 191, 192

Upper arm Figs. 140–149

Vater-Pacini bodies Fig. 170

Vein

- accessory cephalic Figs. 151, 153
- accessory hemiazygos Figs. 103, 105, 110
- angular Fig. 50
- anterior cardiac Figs. 114, 115
- anterior interventricular Figs. 114, 117–119
- anterior jugular Figs. 3–5, 7, 19–24, 33, 36, 37
- anterior of right ventricle Figs. 114, 115
- axillary Figs. 126, 127, 134, 137–139, 141
- azygos Figs. 97–100, 108, 109
- basilic Figs. 143, 144, 149–151, 153–160
- brachial Figs. 138, 139, 141, 144, 155, 156, 160
- cephalic Figs. 123–127, 148–151, 153–156, 158–160, 178, 179, 181

Vein

- circumflex scapular Figs. 134, 140, 141
- communicating Figs. 6, 7, 21
- costoaxillary (Braune) Figs. 130–132, 135–138
- external jugular Figs. 1, 11–13, 15, 16, 25, 28, 30, 33, 34
- external nasal Fig. 50
- facial Figs. 9, 11–13, 30, 33, 34, 36–38
- frontal Fig. 50
- great cardiac Fig. 118
- hemiazygos Figs. 103, 105, 110
- inferior left pulmonary Figs. 104–106, 110, 113 II
- inferior right pulmonary Figs. 99, 108, 109
- inferior thyroid Figs. 4–7, 21–23, 25, 110, 113 I, 114, 115
- internal jugular Figs. 8, 9, 11–18, 22, 25, 31
- internal thoracic Figs. 85, 94, 95, 108, 109, 112, 113 I, 114, 115
 - internal thoracic, perforating branches Figs. 94, 95
- lateral thoracic Fig. 95
- left brachiocephalic Figs. 96, 102, 103, 108, 110, 112, 113 I, 114–117
- left coronary Fig. 118
- left ventricle, posterior Figs. 113 I, 113 II, 121
- lingual Figs. 9, 11–13, 29
- mammary Figs. 93, 95
- maxillary Fig. 18
- medial mammary Fig. 95
- median antebrachial Figs. 150–156, 158, 159, 181
- median basilic Figs. 149, 150, 152, 154–156
- median cephalic Figs. 149–156
- median cubital Figs. 151–154, 158–160
- median of neck Figs. 19, 20
- median profunda Figs. 150, 154, 155, 158, 160
- mediastinal Figs. 103, 104
- middle cardiac Figs. 113 I, 113 II, 121
- middle temporal Figs. 37, 46, 50
- middle thyroid Figs. 9, 23, 24, 27
- pericardiacophrenic Figs. 102, 103, 111, 113 I
- pharyngeal Figs. 17, 18, 39
- posterior auricular Fig. 40
- posterior intercostal Figs. 95, 109, 110
- posterior intercostal, lateral mammary branch Fig. 95
- posterior interventricular Figs. 113 I, 113 II, 119, 121
- prevertebral Fig. 28
- retromandibular Figs. 11, 13–15, 34, 36–38, 41
- right brachiocephalic Figs. 108, 109
- right marginal Figs. 112, 114, 115
- sternocleidomastoid Fig. 8
- subclavian Fig. 127
- submental Fig. 33
- subscapular Fig. 134
- superficial temporal Figs. 36–39, 46–48
- superior left pulmonary Figs. 100, 103–106, 113 II
- superior left pulmonary, anterior branch Figs. 103, 105
- superior left pulmonary, apicoposterior branch Figs. 103–106

Vein

superior left pulmonary, lingular branch Figs. 103–105
superior ophthalmic Figs. 49, 50
superior right pulmonary Figs. 98–100
superior right pulmonary, anterior branch Figs. 99, 100
superior right pulmonary, apical branch Figs. 99, 100
superior right pulmonary, middle lobar branch Figs. 99, 100
superior right pulmonary, posterior branch Figs. 99, 100
superior thyroid Figs. 6, 7, 9, 11–13, 17, 21–25, 27, 28
superior thyroid, cricothyroid branch Fig. 22
supraorbital Fig. 50
supratrochlear Fig. 50
thoracoacromial Fig. 134
thoracodorsal Figs. 129, 139–141
thoracoepigastric Figs. 137–139
thymic Figs. 96, 102, 103, 110
thyroid ima Figs. 108, 113 I, 114, 115
transverse cervical Fig. 31
transverse facial Fig. 50
vertebral Figs. 27, 28

Vena cava

inferior Figs. 113 I, 113 II, 121, 122
inferior, valve Fig. 122
left, fold Figs. 113 I, 113 II
superior Figs. 97–100, 108, 109, 112, 113 II, 116, 121, 122
superior orifice Fig. 122

Vena comitans Figs. 155, 156, 159, 160, 164

Venous access Fig. 152

Venous valves Fig. 153

Ventricle

fourth Fig. 60

fourth, tela choroidea Fig. 60

left Figs. 101, 112, 114, 117–122

right Figs. 112, 113 II, 114–122

Vertebral arch, lamina Figs. 75, 77

Vertebral column Figs. 16, 108, 109

Vertebral ganglion Figs. 28, 29

Vertebral region, lumbar part Fig. 77

Vertebrolumbar region Figs. 72, 75

Vestibular (ventricular) fold Fig. 9

Vinculum breve Fig. 175

Vinculum longum Fig. 175

Vocal fold Fig. 9

Wrist Fig. 201

Xiphisternal synchondrosis Fig. 103

Xiphoid process Figs. 79, 96, 102

Zygoma Figs. 42–45, 49, 50

Zygomatic arch Figs. 41, 47, 48

Zygomatic process Figs. 42–45